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THOMSON'S
NEW GRADED SERIES

NEW
MENTAL ARITHMETIC



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THOMSON'S NEW GRADED SERIES.

° NEW

MENTAL
ARITHMETIC:

FOR

PRIMARY DEPARTMENTS

By JAMES B. THOMSON, LL. D.,
AUTHOR OF DAY & THOMSON'S ARITHMETICAL SERIES; EDITOR OF DAY'S
SCHOOL ALGEBRA, LEGENDRE'S GEOMETRY, ETC.

NEW YORK:
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THOMSON'S NEW GRADED SERIES.

IN THREE BOOKS.

I. NEW MENTAL ARITHMETIC.

(For Primary Departments.)

II. NEW RUDIMENTS OF ARITH-

METIC. (For Intermediate Departments.)

III. NEW PRACTICAL ARITHMETIC.

(For Grammar Departments.)

THOMSON'S SUPPLEMENTARY COURSE.

FOR HIGHER INSTITUTIONS. (*In preparation.*)

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PREFACE.

THE New Mental Arithmetic now presented to the public, is the first of the three books which constitute the author's "New Graded Series."

The work is designed for primary classes. It begins with *Counting*, and proceeds step by step through the *simple combinations* of whole numbers, the *elementary operations* in Fractions, and closes with a few practical exercises in Compound Numbers. The questions, at first, refer to *sensible objects* with which the pupil is familiar. As he becomes acquainted with the solution of *concrete* examples, he is gradually introduced to those containing *abstract* numbers and more *difficult combinations*.

From the outset, the learner is taught to illustrate for himself the *increase* and *decrease* of Numbers, the *formation* of the Tables, etc., by counters, the slate, and the blackboard. This method has been adopted from a conviction of its *superiority* as an *educational force*, over others in use.

1. All admit that the *first lessons* in counting and the combinations of numbers should be given in connection with *sensible objects*—objects addressed to the *eye*, or the *touch*, or to both. But *counters* can be both *seen* and *handled* by the pupil; therefore they have a decided advantage over *pictures*, which are presented to the *eye only*.

2. Next, the method by counters has the merit of *flexibility* and *comprehensiveness*. Instead of a few stereotyped objects on a printed page, selected for the occasion, and incapable of change to meet the different conditions of other questions, the slate, the blackboard, and surrounding portable objects present facilities for illustration as *diversified* as the varied conditions of problems, and as *comprehensive* as the operations and principles to be illustrated.

3. Again, the plan of requiring beginners to illustrate the first steps in numbers by counters, etc., is both *simple* and *efficient* in developing their intellectual powers. Abstract explanations, *are seldom understood* by a child, and therefore fail to *strengthen* his intellect. Pictorial illustrations excite and amuse his fancy; but it cannot be denied they too often *divert* his mind from the principle to be illustrated, and leave upon it no *sharp, well-defined impression* of its truth.

The method here employed is readily *understood* by the pupil, and is calculated to *concentrate* his thoughts upon the thing to be done. It also calls his *judgment* into exercise, and *strengthens* his memory. The hands help the head. Their agency fixes the attention, and photographs the principle upon the mind.

4. Another advantage of personal illustrations is the *pleasing* and *profitable* exercise they afford the pupil. To show by counters or upon the blackboard that five and two are seven, that three times four are twelve, is a *great feat* for a child; and the thrill of delight he feels at its accomplishment, cannot fail to create an interest in his lessons, and bar the door against idleness and mischief.

5. This method also affords the teacher *superior facilities* for imparting a knowledge of Numbers to his pupils. Released from the shackles of stereotyped immovable objects and prosy explanations, he is free to choose his *tools*, free to decide *how much* and *what kind* of help to give, and free to determine *where* to *begin* and *where* to *stop*. Such illustrations are invested with that subtle, mysterious influence of sympathy, which gives them a *charm* and a *propelling power* on the progress of pupils which lifeless pictures and written language can never command.

With these brief explanations, and many thanks for the generous reception of his former series, the author submits the work to teachers and the guardians of education, with the hope it may give an impulse to the study of Mental Arithmetic, and prove an auxiliary to intellectual advancement.

J. B. THOMSON.

NEW YORK, Aug. 1872.

SUGGESTIONS.

THE following Suggestions are submitted, not as *arbitrary* rules, but as *practical hints*, to be adopted so far only as they meet the wants of the class.

1. The *best* mode of instruction, is that which most effectually awakens a pupil's *attention*, and *creates* in him a determination to educate himself. Any method, therefore, which does not lead him to *think* and *reason*, is of little or no value, because it fails to *develop* the *elements* of manhood.

2. Beginners in Mental Arithmetic should be furnished with suitable tools, as slates, blackboards, numeral frames, counters, counting boards, etc.,* and *be taught to use* them in learning to count, and in illustrating the elementary combinations and principles of numbers.

3. After children learn to repeat the names of numbers, particular care should be taken that they *comprehend* the meaning of the terms; that they have a correct idea of *more* and *less*; that *eleven*, for example, is more than seven and less than thirteen. Their minds should also be carried forward from *concrete* to *abstract* numbers, and from *particular* to their *universal* application. On being asked the meaning of "three," a child once showed his *third* finger—the one which he had been accustomed to count in the *third* place.

4. Do not attempt to teach *too many things* at one lesson. The attention of children can be kept *active* but a short time

* The "Counting Board" is a new and valuable accession to the apparatus of primary schools. Its length depends upon the size of the recitation room, and the number of pupils in the class. When placed against the wall, its width is usually from 15 to 18 inches; the upper surface is divided into parts by distinct marks or strips of wood; the edges are faced with a plain molding, raised sufficiently to prevent the counters from rolling off. If placed in the middle of the room, it should be twice this width, to allow pupils to stand on either side of it.

without fatigue. As soon as they begin to show signs of weariness, the exercise should be closed.

5. The *Tables* should be carefully illustrated and understood before they are committed to memory. After this the pupil should make them so familiar, that when the combination of any two digits is required, the *result* shall at once flash upon his mind.

6. The language employed in verbal explanations should be *simple* and in *point*, giving just help enough to lead the pupil to discover the principle in question. More than this is not only *useless* but *hurtful*.

7. After a principle has been explained, the pupil should be required to *reproduce* both the *explanation* and the *principle*. This will show whether the point is *understood*, and if understood, will *fix* it in his mind.

8. In recitations special pains should be taken to secure the *attention* of the class, to keep every mind *active*, and *ready* to answer any question proposed. Where listlessness or mischief prevails, recitations are useless.

9. Particular attention should also be paid to the *method* of *solving* and *reciting* problems. It is not enough that a pupil gives the right answer. The steps in the reasoning should be *legitimate*, and the process stated in *correct* language.

10. It is not advisable to require the *same formula* of reasoning in every solution. Any form originated by the pupil is admissible, provided it be *logical* and *properly expressed*. There is a choice, however, in the *modes* of analysis, and unquestionably *that form is best*, which is the most *simple*, *clear*, and *concise*. While latitude is allowable in the modes of analysis, pupils should be encouraged to *aim* at the best.

11. In the curriculum of studies for *primary* and *intermediate* classes, Mental Arithmetic is worthy of a more prominent place than it commonly receives. As an *intellectual discipline*, it is confessedly *unsurpassed* by any other branch, and as a *preparation* for the practical duties of life, it is *unequaled*. A thorough knowledge of it is a "ready reckoner," which is at once *reliable*, always *at hand*, and of *universal application*.

MENTAL ARITHMETIC.

PRELIMINARY EXERCISES.

LESSON I.

TO TEACHERS.—The following Lessons assume that the class have an imperfect knowledge of *counting*, and of *elementary numbers*. The object is to show them practically *how many things* each number expresses, and impart to them a *distinct idea of more and less*.

1. How many of these little girls and boys can count? All who can, may hold up a hand.

2. The teacher puts down a counter*, as a book, and asks, "How many books are here?" The class answer, "*One* book." Putting down another, "How many now?" "*Two* books." Putting down another, "How many now?" "*Three* books."

3. Hand me *one* book. Hand me *two* books. Hand me *three* books.

4. Each may show me *one* finger. Show me *two* fingers. *Three* fingers. *Four* fingers. *Five* fingers.

5. When you say, one, two, three, four, five, etc., what is it called?

Ans. Counting.

* The teacher is supposed to be furnished with a *Blackboard*, a *Numerical Frame*, and a *box of Counters*; the pupils with *small slates* and *pencils*. For "counters," he may use any convenient portable objects; as, pebbles, bits of paper, pencils, cents, etc. Blocks of one, two, or three cubes, and so on, up to a block of ten cubes, distinctly marked upon it, are also valuable aids.

6. Again, putting down three books and then another, the teacher asks, "How many now?" "*Four* books." Putting down another, "How many?" "*Five* books."

7. The first child may hand me "*one* book." The next "*three* books." The next "*two* books." The next "*four* books." The next "*five* books."

8. Each may hold up *two* fingers. *Four* fingers. *Three* fingers. *Five* fingers.

 The thumbs are often regarded as fingers, and in counting may be so considered by the class.

9. Make two straight marks upon your slate; now make another beside these, and count them.

10. Make one more beside these, and count them.

11. Make one more, and count them all.

12. What number comes next after *one*? (The class answer in concert.) What comes after *two*? What after *three*? After *four*?

13. *Two* comes after what? *Three* after what? *Four* after what? *Five* after what?

14. What comes next before *five*? What before *four*? Before *three*? Before *two*? Before *one*?

15. Count from one to five in concert.

16. Count from five back to one in concert.

17. How many of the class can express the numbers one, two, three, four, five, by *figures*.

18. Make the figure 1 (one) upon your slates (the teacher writing it upon the blackboard.)

19. Make the figure 2 (two.) The figure 3 (three.) The figure 4 (four.) The figure 5 (five.) Make each of these figures twice more.

LESSON II.

TO TEACHERS.—In no case should pupils be permitted to commence a new lesson until familiar with the preceding. The exercises should be varied according to the age and amount of knowledge of the class, and be continued till the object is secured.

1. The teacher making five straight marks upon the blackboard, directs the class to count as he points to each.

2. Placing another mark beside these, he asks, "How many does this make?" The class repeating the number as before. Placing another beside the last, "How many now?" Placing another, "How many?" Placing another, "How many?" Placing another, "How many?"

3. Hold up *six* fingers. Hold up *seven* fingers. Hold up *eight* fingers. *Nine* fingers. *Ten* fingers.

4. Make six straight marks in a line upon your slates. Make seven marks. Eight marks. Nine marks. Ten marks.

5. What comes next after *five*? After *six*? After *seven*? After *eight*? After *nine*?

6. Six comes next after what? Seven comes after what? Eight? Nine? Ten?

7. One cent and one more are how many? Two cents and one more? Three and one more? Four and one more? Five and one more? Six and one more? Seven and one more? Eight and one more? Nine and one more?

8. What comes next before ten? Before nine? Before eight? Before seven? Before six?

9. Show me four fingers. Six fingers. Eight fingers. Ten fingers.

10. Count from one to ten, three times in concert.

11. Count backward from ten to one; as, ten, nine, eight, etc., three times.

12. Write in a neat hand upon your slates the figures 6 (six), 7 (seven), 8 (eight), 9 (nine.)

LESSON III.

1. How many hands have you? How many feet?

2. How many hands and feet counted together?

3. Hold up your right hand:

4. How many thumbs has it? How many fingers?

How many fingers and thumbs?

5. How many fingers and thumbs has your left hand?

6. Clap your hands five times. Six times.*

7. Clap your hands seven times. Nine times.

8. Clap your hands eight times. Ten times.

9. Hold up six fingers. Eight fingers. Seven.

10. Show me three fingers on your right hand, and two on your left.

11. Which is the more, three fingers, or two fingers?

12. Show me four fingers on your right hand, and three on your left.

13. Which is the more, four fingers, or three fingers?

* Children *delight* in having something to do. Simple manual exercises, making marks upon the slate or blackboard, etc., not only please them, but awaken an interest in the study.

14. The first boy may make four straight marks in a row upon the blackboard. (The others copy them on their slates.)

The first girl make five marks under the others.

15. Count the marks in the upper row, orally. (The teacher pointing to each.)

16. Count those in the lower row.

17. Which is the greater number, four marks or five marks?

18. The next boy make seven marks upon the blackboard.

19. The next girl make eight marks under them.

20. Count each row.

21. Which is the greater number, seven or eight?

22. The next boy make eight marks upon the blackboard. The next make nine under them.

23. Which is the greater, eight or nine?

24. What are figures?

Ans. Figures are characters used to express numbers.

25. Write the figures from *one* to *ten*.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

one, two, three, four, five, six, seven, eight, nine, ten.

26. What is a single thing called?

Ans. A unit or *one*.

27. What is the greatest number of single things that can be expressed by *one* figure?

Ans. Nine.

28. How is ten expressed?

Ans. By writing 1 in the *second* place and a *cipher* on the right; as 10.

LESSON IV.

TO TEACHERS.—The object of this Lesson is to illustrate the numbers from *ten* to *twenty* inclusive. For this purpose, either the numeral frame, the blackboard and slates, or counters may be used, as most convenient.

1. Taking some books, and laying them down one at a time, the class count *one, two, three*, and so on, to *ten*. How many books are in the pile?

Ans. Ten.

2. If I put another book by the side of these, how many will there be?—*Eleven*. Count to eleven.

3. If I put another still, how many will there be?—*Twelve*. Count twelve.

4. Putting another, how many?—*Thirteen*. Count thirteen.

5. Putting another, how many?—*Fourteen*. Count fourteen.

6. Another, how many?—*Fifteen*. Count fifteen.

7. Another, how many?—*Sixteen*. Count sixteen.

8. Another, how many?—*Seventeen*. Count seventeen.

9. Another, how many?—*Eighteen*. Count eighteen.

10. Another, how many?—*Nineteen*. Count nineteen.

11. Another, how many?—*Twenty*. Count twenty.

12. The first boy count *five* as I place the counters.

13. Beginning at six, the next count to *ten*.

14. Beginning at eleven, the next count to *fifteen*.

15. Beginning at sixteen, the next count to *twenty*.

16. The class may now count twenty, twice in concert, and rapidly, as I move the counters.

17. Ten slates and one slate more are how many?
18. Eleven slates and one slate?
19. Twelve books and one book?
20. Thirteen pencils and one pencil?
21. Fourteen marbles and one marble?
22. Fifteen caps and one cap?
23. Sixteen chestnuts and one chestnut?
24. Seventeen apples and one apple?
25. Eighteen pears and one pear?
26. Nineteen peaches and one peach?
27. What comes after ten? After eleven? After twelve?
28. What comes after thirteen? After fourteen?
29. What comes after sixteen? After seventeen?
30. Count from ten to twenty, three times, in concert.
31. From twenty to ten, three times.

LESSON V.

1. Write the figures denoting the numbers from *ten to twenty*:

11, 12, 13, 14, 15, 16, 17, 18, 19, 20.
eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty.

2. How many does eleven denote?

Ans. Ten and one.

3. How many does twelve denote?

Ans. Ten and two.

4. What is the meaning of *thirteen*? *

Ans. Ten and three.

* Children will find great assistance in comprehending the meaning of the terms from ten to a hundred by directing attention to their derivation. Thus thirteen is from *three* and ten; fourteen is from four and ten, etc.

5. The meaning of fourteen? Of fifteen? Sixteen? Seventeen? Eighteen? Nineteen?

6. Count from twenty to thirty three times in concert; as twenty-one, twenty-two, twenty-three, etc.

7. Count from thirty to forty in like manner.

8. Count from forty to fifty.

9. From fifty to sixty.

10. From sixty to seventy.

11. From seventy to eighty.

12. From eighty to ninety.

13. From ninety to a hundred?

14. What is the second ten called? The third? The next ten? The next? The next?

15. What does the word *twenty* literally denote?

Ans. The first syllable *twen*, signifies *two*, and the last syllable *ty*, signifies *ten*. Hence, the word *twenty* denotes *two-tens*.

16. What does thirty denote? *Ans.* Three tens.

17. What does thirty-seven denote?

Ans. Three *tens*, and seven *units* or *ones*.

18. What does forty denote? Forty-two? Forty-five?

19. What does fifty denote? Fifty-three? Fifty-eight?

20. What does sixty denote? Sixty-six? Sixty-seven?

21. What does seventy denote? Seventy-three? Seventy-eight?

22. What does eighty denote? Eighty-four? Eighty-one?

23. What does ninety-nine denote?

24. How many tens in a hundred?

Ans. Ten tens.

LESSON VI.

1. Write the figures denoting the numbers from twenty to thirty.
2. What do the figures in 23 denote?
3. What do the figures in 25 denote? In 24? In 27?
4. Write the figures from thirty to forty. Write those from forty to fifty.
5. Write from fifty to sixty. From seventy to eighty.
6. Write from ninety to a hundred.
7. What is the greatest number that can be expressed by two figures?

Ans. Ninety-nine.

Write the following numbers in figures:

- | | |
|------------------|-------------------|
| 8. Twenty-three. | 16. Forty-one. |
| 9. Thirty-two. | 17. Fifty-eight. |
| 10. Seventeen. | 18. Sixty. |
| 11. Nineteen. | 19. Fifty-seven. |
| 12. Twenty-nine. | 20. Seventy-four. |
| 13. Thirty-five. | 21. Eighty-five. |
| 14. Forty-seven. | 22. Ninety-four. |
| 15. Twenty. | 23. Ninety-nine. |

24. How is a hundred expressed?

Ans. By writing 1 in the third place with two ciphers on the right; as 100.

25. What do figures express when standing in the first three places?

Ans. Standing in the first place on the right, they denote *units*; in the second place, *tens*; in the third place, *hundreds*.

26. Write one hundred and twenty-three.
27. Write two hundred and thirty-six.

28. How is a thousand expressed?
By 1 with three ciphers on the right; as 1000.
29. Write one thousand and two hundred.

LESSON VII.

To **TEACHERS**.—The object of this Lesson is to develop the idea of reading small numbers expressed by figures. The exercises should be varied if needs be, so as to meet the capacity of every pupil.

1. What does the figure 7 standing alone denote?
Ans. Seven *units* or *ones*.
2. What do the figures 16 standing together denote?
Ans. One *ten* and six *units*, or sixteen.
3. What do the figures 27 standing together denote?
Ans. Two *tens* and seven *units*, or twenty-seven.
4. How read the figures 38? *Ans.* Thirty-eight.
5. How read the figures 45? *Ans.* Forty-five.

Copy and read the following numbers:

6. 17.	15. 57.	24. 234.
7. 13.	16. 65.	25. 345.
8. 19.	17. 78.	26. 671.
9. 21.	18. 83.	27. 795.
10. 34.	19. 94.	28. 843.
11. 40.	20. 99.	29. 999.
12. 37.	21. 100.	30. 1110.
13. 49.	22. 142.	31. 2030.
14. 54.	23. 165.	32. 9000.

 Of all the departments of Education, there is no one in which *oral instruction* is more important than in teaching children the *first steps* in numbers. To meet their wants and secure rapid progress in this direction, every written exercise, however happy and appropriate, requires to be *varied* and *supplemented* by the living voice.

ADDITION.

LESSON I.

TO TEACHERS.—This Lesson is designed to familiarize the class with adding 1 to each of the digits. It passes from familiar objects that are present, to those that are absent.

1. The teacher holding up a book, asks, How many books have I in my hand? "One book."
2. How many in the other hand? "None."
3. How many are 1 book and 0 books? "One book."
4. Taking a book in each hand, How many books do I now show? "Two books."
5. How many are 1 book and 1 book? "Two books."
6. If I lay down 1 book, how many shall I have?
7. Taking 2 books in one hand and 1 in the other, How many books do you see? "Three books."
8. Two books and 1 book are how many? "Three books."
9. If I have 3 books, and give you 1, how many shall I have left? "Two books."
10. If I have 3 apples in one hand and 1 in the other, how many apples have I in both hands? "Four apples."

Show this with your fingers.

11. Three apples and 1 apple are how many?
12. If I have 4 apples and give you 1, how many shall I have?

Show this with your fingers?

13. How many are 4 pencils and 1 pencil?

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ION.

1. 1.

ed to familiarize the class with
from familiar objects that are

book, asks, How many
One book."

and? "None."

o books? "One book."
and, How many books
3."

1 book? "Two books."

v many shall I have?
hand and 1 in the other,

"Three books."

re how many? "Three

give you 1, how many
oks."

one hand and 1 in the
have I in both hands?

ngers.

pple are how many?

ive you 1, how many

pencil?

LESSON VI.

1 and 5 are 6	4 and 5 are 9	7 and 5 are 12
2 and 5 are 7	5 and 5 are 10	8 and 5 are 13
3 and 5 are 8	6 and 5 are 11	9 and 5 are 14

1. If you pick 5 pears from one tree, and 2 from another, how many pears will you have?

2. How many are 4 hats and 5 hats? Show this by counters. 4 from 9 leaves how many?

3. If one tree bears 5 oranges, and another 3 oranges, how many oranges will both bear?

4. Julius found two birds' nests, one having 4 and the other 5 eggs: how many eggs had both?

5. If a whistle costs 5 cents, and a top 6 cents, how many cts. will both cost? 6 from 11 leaves how many?

6. How many are 8 and 5? 8 from 13 leaves how many?

7. Homer has 7 grey rabbits, and his sister has 5 white ones: how many rabbits have both? 7 from 12 leaves how many? 5 from 12 leaves how many?

8. How many are 5 apples and 9 apples? 5 bananas and 8 bananas?

9. Six marbles and 5 marbles are how many?

10. How many are 2 and 5? 4 and 5? 3 and 5? 5 and 6? 5 and 7? 8 and 5? 9 and 5?

 **DICTATION EXERCISES.**—Increased interest in the study will be awakened by *dictation* or *sight* exercises upon the slate and blackboard. Each combination should contain *two* or *more* figures placed one under the other, as at the foot of the following pages. As the teacher points to each figure, the class should give the result rapidly, *at sight*.

LESSON VII.

1 and 6 are 7	4 and 6 are 10	7 and 6 are 13
2 and 6 are 8	5 and 6 are 11	8 and 6 are 14
3 and 6 are 9	6 and 6 are 12	9 and 6 are 15

1. Frank has 3 young doves and 6 old ones: how many has he in all? 3 from 9 leaves how many?

2. How many are 6 birds and 5 birds? 5 from 11 leaves how many?

3. James saw 4 squirrels on a tree and 6 on the ground: how many did he see in all?

4. If you have 8 marbles in one pocket and 6 in another, how many have you in both? 8 from 14 leaves how many?

5. Sarah has two rose-bushes, one having 7 roses, the other 6: how many roses have both? 7 from 13 leaves how many?

6. If one hen has 6 chickens and another has 9, how many have both? 8 from 14 leaves how many?

7. Henry paid 8 cents for a slate and 6 cents for a writing-book: how much did he pay for both?

8. Nine carriages and 6 carriages are how many?

9. Charles picked 5 quarts of chestnuts and his brother 6 quarts: how many quarts did both pick?

10. Horace has 6 peanuts in one hand and 8 in the other: how many has he in both?

11. Five and what are 11? 6 and what are 12? 8 and what are 14? 7 and what are 13? 9 and what are 15?

12. WRITE { 6, 8, 6, 6, 7, 6, 9, 5, 6.
AND ADD. { 4, 6, 5, 6, 6, 8, 6, 6, 7.

LESSON VIII.

1 and 7 are 8	4 and 7 are 11	7 and 7 are 14
2 and 7 are 9	5 and 7 are 12	8 and 7 are 15
3 and 7 are 10	6 and 7 are 13	9 and 7 are 16

1. Dick has 3 young canary birds and 7 old ones: how many has he in all? 3 from 10 leaves how many?

2. If a boy has 7 peaches and buys 2 more, how many peaches will he have? 2 from 9 leaves how many?

3. A farmer has 4 cows in one pasture and 7 in another: how many cows has he in both?

4. If Martha has 7 books and her sister has 8, how many have both? 8 from 15 leaves how many?

5. Seven melons and 6 melons are how many?

6. Herbert has 5 white doves and 7 dark ones: how many doves has he? 5 from 12 leaves how many?

7. A school-house has 7 shade trees on one side and 6 on the other: how many has it on both sides?

8. A grocer sold 7 pounds of butter to one customer and 7 to another: how much did he sell to both?

9. Timothy gave 9 chestnuts for a whistle and 7 for a top: how many did he give for both?

10. In a certain class there are 7 boys and 8 girls: how many pupils are there in the class?

11. George has 9 pears, and Henry has 7 more than George: how many pears has Henry?

12. Five and what are 12? 6 and what are 13? 4 and what are 11? 8 and what are 15? 7 and what are 14? 9 and what are 16?

13. WRITE { 8, 4, 7, 7, 6, 7, 7, 9, 10.
AND ADD. { 3, 8, 5, 7, 7, 9, 8, 7, 7.

LESSON IX.

1 and 8 are 9	4 and 8 are 12	7 and 8 are 15
2 and 8 are 10	5 and 8 are 13	8 and 8 are 16
3 and 8 are 11	6 and 8 are 14	9 and 8 are 17

1. If a pound of sugar costs 8 cents and a lemon 3 cents, what will both cost? 3 from 11 leaves how many?

2. Henry's kite line is 8 yards long, and 2 yards have been broken off: how long was it at first?

3. One of my peach-trees has 5 peaches on it and another 8: how many peaches have both?

4. Morris carried 6 apples to school and left 8 at home: how many apples had he in all?

5. How many are 8 cherries and 4 cherries?

6. Gilbert has 8 cents in his pocket and has lost 7: how many cents had he? 7 from 15 leaves how many?

7. A lady has 8 flower-pots standing at one window and 6 at another: how many has she at both?

8. A farmer sold 8 turkeys and has 8 left: how many had he? 8 from 16 leaves how many?

9. Marco has 8 young pigeons and 4 old ones: how many has he in all? 4 from 12 leaves how many?

10. Minnie's father paid 9 dollars for her muff and 8 dollars for her tippet: how much did he pay for both?

11. If a house has 8 windows in the front and 9 in the rear, how many windows has it?

12. Four and what are 12? 6 and what are 14? 5 and what are 13? 7 and what are 15?

13.	WRITE	{	8,	8,	8,	7,	8,	8,	8,	9,	10.
	AND ADD.	{	4,	3,	5,	8,	6,	8,	9,	8,	8.
		{	2,	4,	3,	5,	4,	6,	7,	5,	8.

LESSON X.

1 and 9 are 10	4 and 9 are 13	7 and 9 are 16
2 and 9 are 11	5 and 9 are 14	8 and 9 are 17
3 and 9 are 12	6 and 9 are 15	9 and 9 are 18

1. If you pay 9 cents for an inkstand and 2 cents for a pen, how much will you pay for both?

2. Kate has 4 pears more than her brother, who has 9: how many pears has she? 4 from 13 leaves how many?

3. Three lemons added to 9 lemons are how many?

4. A dairywoman sold 5 cheeses, and has 9 left: how many had she at first? 5 from 14 leaves how many?

5. If you write 9 lines one day and 8 the next, how many lines will you write in both days?

6. Joseph paid 7 shillings for a cap and 9 shillings for a sled: how much did he pay for both?

7. If you have 8 plums, and I give you 9 more, how many will you have? 8 from 17 leaves how many?

8. Nine overcoats and 7 overcoats are how many?

9. If a drum costs 9 dollars and a gun costs 8 dollars, how much will both cost?

10. Copy and add the following columns:

9	4	9	5	9	7	9	8	10.
3	9	6	9	8	9	9	9	9.
2	4	3	5	3	4	5	6	7.
5	6	7	4	6	3	8	5	8.
7	5	3	6	4	7	4	3	2.

 Sight exercises, in adding columns of single figures, should be *supplemented* by the teacher until the class can add with *accuracy* and *rapidity*.

LESSON XI.

1. What is Addition?

Ans. Addition is uniting two or more numbers in one.

2. What is the number obtained by addition called?

Ans. The Sum or Amount.

3. When we say 7 and 8 are 15 and 9 are 24, which is the *sum* or *amount*?

4. How many are 2 chairs, 7 chairs, and 5 chairs?

5. A farmer gave to one boy 7 apples, to another 8, and to another 4: how many did he give to all?

6. If you spend 8 cents for an inkstand, 10 cents for a slate, and 2 cents for pencils, how much will you spend for all?

7. How many are 8 and 3 and 7?

8. How many are 9 and 5 and 6?

9. How many are 6 and 8 and 4?

10. How many are 8 and 7 and 4 and 2?

11. William gave 18 cents for a canary-bird and 10 cts. for seed to feed it with: what did he pay for both?

12. If it takes a lad 8 minutes to do one example, 10 minutes to do another, and 6 minutes to do another, how long will it take him to do the 3 examples?

13. How many are 5 cents, 8 cents, and 7 cents?

14. Horace paid 8 cents for figs; 6 cents for cherries, and 5 cents for an orange: what did he pay for all?

15. Julia has 9 dolls, Helen 7, and Lizzie 8: how many dolls have all?

16. How many are 7 and 8 and 7?

17. How many are 5 and 10 and 4?

18. A shopkeeper sold 12 marbles to one lad, 8 to another, and 10 to another: how many did he sell to all?

19. If 1 rosebush has 8 buds, another 9, another 7, and another 4, how many buds have all?

20. If you pay 9 dollars for a music-box, 7 dollars for a flute, and 6 dollars for a drum, what will they all cost you?

21. A man paid 6 dollars for a hat, 10 dollars for a vest, and 7 dollars for a pair of boots: how much did he pay for all?

22. A farmer sold 5 bushels of corn to one man, 6 bushels to another, and 3 to another: how many bushels did he sell?

23. If you pay 7 cents for candy, 5 cents for an orange, and 3 cents for a pear, how many cents will you pay for all?

24. How many are 8 cents, and 9 cents, and 7 cents?

25. How many are 5 plums, and 6 plums, and 8 plums?

26. If you give 12 chestnuts to one of your playmates, 6 to another, and 8 to another, how many will you give to all?

27. How many are 4 and 7 and 5 and 3?

28. How many are 6 and 4 and 9 and 5?

29. How many are 5 and 8 and 7 and 2?

30. How many are 8 and 6 and 5 and 3?

31. How many are 7 and 5 and 6 and 8?

32. How many are 8 and 3 and 4 and 5 and 2?

33. If one tree bears 10 peaches, another 9, and another 8, how many will all bear?

34. If you have 12 marbles and Charles gives you 8 more, how many will you have?

SUBTRACTION.

LESSON I.

TO TEACHERS.—The object of this Lesson is to make the pupil familiar with the results of subtracting a unit or 1 from the several digits.

1 from 1 leaves 0	1 from 6 leaves 5
1 from 2 leaves 1	1 from 7 leaves 6
1 from 3 leaves 2	1 from 8 leaves 7
1 from 4 leaves 3	1 from 9 leaves 8
1 from 5 leaves 4	1 from 10 leaves 9

1. Putting down 2 counters, as 2 pencils, the teacher asks, How many pencils are here?

Ans. "Two pencils."

2. If I take away one, how many are left? "One pencil."

3. Francis had 3 pears, and gave one to his sister: how many had he left?

ANALYSIS.—1 pear from 3 pears leaves 2 pears. Therefore, he had 2 pears left.

4. If 1 peach is taken from 4 peaches, how many will be left? Show this by counters.

5. One slate taken from 7 slates, leaves how many?

6. If you have 8 cents in your pocket, and lose 1, how many will you have left? 7 and what make 8?

7. Amelia had 9 tulips, and gave 1 to Lucy, how many did she have left? 8 and what are 9?

8. Four is 1 more than what number? 6 is 1 more than what? 8 is 1 more than what? 9 than what?

LESSON II.

TO TEACHERS.—The formation of the subsequent parts of the Subtraction Table may be illustrated upon the blackboard, in the following manner:

Make 2 marks (11), crossing out both, none are left, 11

Make 3 marks (111), crossing out 2, one is left, 11 1

Make 4 marks (1111), crossing out 2, two are left, 11 11

The class copy and complete the Table as below.

2 from 2 leaves 0	2 from 7 leaves 5
2 from 3 leaves 1	2 from 8 leaves 6
2 from 4 leaves 2	2 from 9 leaves 7
2 from 5 leaves 3	2 from 10 leaves 8
2 from 6 leaves 4	2 from 11 leaves 9

1. Lewis had 4 chestnuts, and lost 2 of them: how many did he have left?

2. Ellen gained 6 credit marks, which was 2 more than Susan gained: how many did Susan have?

3. William had 5 chickens, and 2 of them died: how many had he then? 2 and 3 are how many?

4. If there are 7 caps hanging up, and you take down two of them, how many will be left? 2 and what make 7?

5. Charles picked 8 apples, but finding 2 of them bad, threw them away: how many had he left?

6. There were 9 birds on a fence, but 2 flew away: how many were left? 2 and 7 are how many?

7. If you take 2 from 10, how many will be left?

8. Walter having 11 cents, gave 2 to a beggar: how many cents had he then? 2 and 9 are how many?

9. Two from 5 leaves how many? 2 from 4? 2 from 6? 2 from 8? 2 from 7? 2 from 9?

LESSON III.

3 from 3 leaves 0	3 from 8 leaves 5
3 from 4 leaves 1	3 from 9 leaves 6
3 from 5 leaves 2	3 from 10 leaves 7
3 from 6 leaves 3	3 from 11 leaves 8
3 from 7 leaves 4	3 from 12 leaves 9

1. Richard found 5 pears upon a tree, and picked 3 of them: how many were left on the tree?

2. If you have 6 chickens, and a hawk carries off 3 of them, how many will be left? 3 and 3 are how many?

3. Julia having 8 cents, put 3 of them into the contribution box: how many cents had she left?

4. Fanny is 9 years old, and her brother is 3 years younger: how old is her brother?

5. Roland gathered 3 quarts of chestnuts, and George 8 quarts: how many more did George have than Roland?

6. Homer gained 8 marbles, and afterwards lost all but 3 of them: how many did he lose?

7. A housekeeper bought 12 tumblers, and broke 3 of them going home: how many whole ones had she left?

8. Three melons from 11 melons leave how many?

9. Five is how many more than 3? 6 than 3? 8 than 3? 7 than 3? 9 than 3? 10 than 3? 12 than 3?

10. From 6, 5, 8, 7, 9, 11, 10, 12.

Take 3, 3, 3, 3, 3, 3, 3, 3.

 The *Sight Exercises* at the foot of the page are designed as samples for the blackboard, and embrace such numbers only as the class have learned to subtract. The answers should be given with briskness, as the teacher points to the successive numbers.

LESSON IV.

4 from 4 leaves 0	4 from 9 leaves 5
4 from 5 leaves 1	4 from 10 leaves 6
4 from 6 leaves 2	4 from 11 leaves 7
4 from 7 leaves 3	4 from 12 leaves 8
4 from 8 leaves 4	4 from 13 leaves 9

1. Arvilla had 6 dolls, and gave 4 to her playmates. how many did she keep for herself?

2. Howard had 7 goslings, and a fox caught all but 4: how many did he catch? 4 and 3 are how many?

3. Four watches and what number make 8 watches?

4. Nine squirrels were playing in a wood, and a hunter shot all but 4 of them: how many were shot? 5 and 4 are how many?

5. A lady having lost her purse with 10 dollars in it, gave 4 dollars to the finder: how many dollars had she left?

6. Four and what number make 12?

7. Josiah found 11 mice in a barrel, and caught all but 4 of them: how many did he catch? 4 and 7 are how many?

8. If from 13 yards of muslin you cut 4 yards, how many yards will be left? 4 and 9 are how many?

9. Henry having 12 ducks, sold 4 of them: how many did he then have? 4 and 8 are how many?

10. Six is how many more than 4? 5 than 4? 7 than 4? 9 than 4? 8 than 4? 10 than 4? 12 than 4? 11 than 4?

From	5,	4,	6,	8,	7,	10,	9,	12.
Take	4,	4,	4,	4,	4,	4,	4,	4.

LESSON V.

5 from 5 leaves 0	5 from 10 leaves 5
5 from 6 leaves 1	5 from 11 leaves 6
5 from 7 leaves 2	5 from 12 leaves 7
5 from 8 leaves 3	5 from 13 leaves 8
5 from 9 leaves 4	5 from 14 leaves 9

1. If you have 8 pens and lend 5 of them, how many will you have left? 5 and 3 are how many?

2. Edward paid 7 cents for a top, and sold it for 5 cents: how much did he lose? 5 and 2 are how many?

3. In a class there are 10 girls and 5 boys: how many more girls than boys are there?

4. Five pineapples from 9 pineapples leave how many? 5 and 4 are how many?

5. A hunter fired into a flock of 12 birds and killed 5 of them: how many were left?

6. In a farmyard were 13 cows, 5 of which were lying down: how many were standing?

7. A railroad train having 15 cars, left 5 of them at the first depot: how many passed on?

8. George had 14 marbles, and gave 5 of them to Robert: how many had he left? 5 peaches and 9 peaches are how many?

9. Charles having 13 rabbits, sold all but 5: how many did he sell? 5 and 8 are how many?

10. Eight is how many more than 5? 7 than 5? 6 than 5? 10 than 5? 9 than 5? 12 than 5? 13 than 5? 14 than 5?

From	7,	6,	5,	8,	10,	9,	12,	11.
Take	5,	5,	5,	5,	5,	5,	5,	5.

LESSON VI.

6 from 6 leaves 0	6 from 11 leaves 5
6 from 7 leaves 1	6 from 12 leaves 6
6 from 8 leaves 2	6 from 13 leaves 7
6 from 9 leaves 3	6 from 14 leaves 8
6 from 10 leaves 4	6 from 15 leaves 9

1. If you borrow 10 cents, and return 6, how many cents will you owe?

2. Six watches taken from 9 watches leave how many?

3. A farmer having 11 cows, sold 6 of them: how many had he left? 6 and 5 are how many?

4. A lady bought 12 teacups and saucers, and on her way home broke 6 of each: how many were left? 6 and 6 are how many?

5. Six from 13 leaves how many? 6 and how many make 9?

6. Gertrude invited 15 little girls to a birthday party, and only 6 came: how many declined?

7. In a school-room there are 16 desks, and only 6 are occupied: how many are vacant?

8. Walter bought a book for 14 cents, and paid 6 cents down: how much does he owe for it?

9. Susan is 17 years old to-day: how old was she 6 years ago?

10. Henry has 6 credit marks: how many more must he get to have 13? 6 and 7 are how many?

11. Ten is how many more than 6? 9 than 6? 8 than 6? 12 than 6? 11 than 6? 14 than 6?

12. From 10, 9, 12, 11, 13, 15, 14, 16.

Take 6, 6, 6, 6, 6, 6, 6, 6.

LESSON VII.

7 from 7 leaves 0	7 from 12 leaves 5
7 from 8 leaves 1	7 from 13 leaves 6
7 from 9 leaves 2	7 from 14 leaves 7
7 from 10 leaves 3	7 from 15 leaves 8
7 from 11 leaves 4	7 from 16 leaves 9

1. From a vine having 11 clusters of grapes, I picked 4 clusters: how many clusters were left?
2. In a class of 12 pupils, only 7 were punctual in their attendance: how many were tardy?
3. In a window having 14 panes of glass, 7 were broken by hailstones: how many panes were left?
4. Seven from 13 leaves how many?
5. If I earn 15 dollars a week, and pay 7 dollars for board, how much can I lay up?
6. On a tree there were 10 blackbirds and 7 robins: how many more blackbirds than robins were there? 7 and 3 are how many?
7. Jennie had 16 needles in her needlebook, and took out 7: how many were left?
8. Fred has 7 marbles: how many more must he get to have 17? 7 and 10 are how many?
9. Seven and what number make 15?
10. A rose-bush has 7 roses and 17 buds: how many more buds than roses has it? 7 and what make 18?
11. Seven slates from 18 slates leave how many?
12. Eleven is how many more than 7? 10 than 7? 12 than 7? 13 than 7? 14 than 7? 15 than 7?
13. From 10, 12, 11, 14, 13, 15, 16, 17.
Take 7, 7, 7, 7, 7, 7, 7, 7.

LESSON IX.

9 from 9 leaves 0	9 from 14 leaves 5
9 from 10 leaves 1	9 from 15 leaves 6
9 from 11 leaves 2	9 from 16 leaves 7
9 from 12 leaves 3	9 from 17 leaves 8
9 from 13 leaves 4	9 from 18 leaves 9

1. If you buy a slate for 12 cents, and pay 9 cents down, how much will you owe for it?

2. Nine and what number make 13?

3. School opens at 9 o'clock: how many hours before it will be 12 o'clock? 9 and 3 are how many?

4. What is the difference between the cost of a pineapple and an orange, the price of the former being 18 cents, that of the latter 9 cents?

5. Nine from 14 leaves how many?

6. Rollo is now 9 years old: how many years will it be before he is 16 years old?

7. A man having 17 melons in his garden, had 9 of them stolen: how many were left?

8. Josephine had 18 lines to write, and has written 9 of them: how many lines remain?

9. Nine and what number make 16? 9 and what make 15? 9 and what are 14?

10. If a horse goes 9 miles an hour, and a railroad car 19 miles, how far apart will they be in an hour?

11. Twelve is how many more than 9? 11 than 9? 13 than 9? 15 than 9? 14 than 9? 18 than 9? 17 than 9?

12. From 11, 12, 14, 13, 15, 17, 16, 19.
Take 9, 9, 9, 9, 9, 9, 9, 9.

LESSON X.

1. What is Subtraction ?

Ans. Subtraction is taking one number from another.

2. What is the number to be subtracted called ?

Ans. The Subtrahend.

3. The number from which the subtraction is made ?

Ans. The Minuend.

4. What is the number obtained by subtraction called ?

Ans. The Difference or Remainder.

5. When it is said that 5 from 9 leaves 4, which is the subtrahend ? The minuend ? The remainder ?

6. When it is said that 6 from 13 leaves 7, what is the 6 called ? The 13 ? The 7 ?

7. If the price of a ball is 8 cents, and you hand out a ten cent piece, how much change should you receive ?

8. The price of a spool of cotton is 6 cents, and that of a roll of tape 9 cents : what is the difference in price ?

9. Jane is 14 years old and Sarah 9 years : what is the difference of their ages ?

10. George has 15 doves and Harry 8 : how many more has the former than the latter ?

11. Mary had 14 dollars, and paid 7 dollars for a hat : how much had she left ?

12. If you walk 15 miles in a day, and James walks 8 miles, how much further do you walk than James ?

13. A man has two young pear trees ; one bore 8 pears, the other 12 pears : how many more did one bear than the other ?

14. How many more are 14 than 5 ? 13 than 7 ?

LESSON XI.

TO TEACHERS.—The object of the next three Lessons is to familiarize the learner with the process of adding and subtracting by *decades*. To secure the full benefit of these exercises, the questions, as soon as the principle is understood, should be put and answered with as *much rapidity* as consistent with *distinctness*.

1. How many are 2 and 10? 22 and 10? 32 and 10? 42 and 10? 52 and 10? 62 and 10? 72 and 10? 82 and 10? 92 and 10?*

2. Ten from 12 leaves how many? 10 from 22? 10 from 42? 10 from 52? 10 from 62? 10 from 72? 10 from 82? 10 from 92?

3. How many are 21 and 10? 31 and 10? 41 and 10? 51 and 10? 61 and 10? 71 and 10? 81 and 10? 91 and 10?

4. How many are 21 less 10? 31 less 10? 41 less 10? 51 less 10? 61 less 10? 71 less 10? 81 less 10? 91 less 10?

5. How many are 13 and 10? 23 and 10? 43 and 10? 53 and 10? 73 and 10? 63 and 10? 83 and 10? 93 and 10?

6. How many are 13 less 10? 23 less 10? 33 less 10? 53 less 10? 83 less 10? 63 less 10? 43 less 10? 73 less 10? 93 less 10?

7. How many are 24 and 10? 44 and 10? 34 and 10? 54 and 10? 74 and 10? 64 and 10? 84 and 10? 94 and 10?

8. How many are 24 less 10? 44 less 10? 64 less 10? 34 less 10? 54 less 10? 84 less 10?

NOTE.—Accuracy first, then rapidity.

9. How many are 15 and 10? 35 and 10? 25 and 10? 65 and 10? 55 and 10? 45 and 10? 75 and 10? 95 and 10?

10. How many are 15 less 10? 45 less 10? 25 less 10? 55 less 10? 35 less 10? 75 less 10? 65 less 10? 85 less 10? 95 less 10?

11. How many are 16 and 10? 26 and 10? 46 and 10? 66 and 10? 56 and 10? 76 and 10? 36 and 10? 86 and 10? 96 and 10?

12. How many are 16 less 10? 36 less 10? 56 less 10? 46 less 10? 66 less 10? 26 less 10? 86 less 10? 76 less 10? 96 less 10?

13. How many are 17 and 10? 37 and 10? 47 and 10? 67 and 10? 57 and 10? 27 and 10? 87 and 10? 77 and 10? 97 and 10?

14. How many are 17 less 10? 37 less 10? 27 less 10? 47 less 10? 67 less 10? 57 less 10? 77 less 10? 97 less 10? 87 less 10?

15. How many are 18 and 10? 78 and 10? 68 and 10? 48 and 10? 58 and 10? 38 and 10? 28 and 10? 88 and 10? 98 and 10?

16. How many are 18 less 10? 38 less 10? 28 less 10? 48 less 10? 68 less 10? 58 less 10? 78 less 10? 88 less 10? 98 less 10?

17. How many are 19 and 10? 49 and 10? 39 and 10? 79 and 10? 29 and 10? 69 and 10? 89 and 10? 59 and 10? 99 and 10?

18. How many are 19 less 10? 39 less 10? 59 less 10? 29 less 10? 49 less 10? 69 less 10? 89 less 10? 79 less 10? 99 less 10?

LESSON XII.

1. How many are 20 and 2? 30 and 2? 40 and 2? 50 and 2? 60 and 2? 70 and 2? 80 and 2? 90 and 2?

2. How many are 20 less 2? 30 less 2? 40 less 2? 50 less 2? 60 less 2? 70 less 2? 80 less 2? 90 less 2?

3. How many are 10 and 3? 30 and 3? 20 and 3? 40 and 3? 60 and 3? 50 and 3? 70 and 3? 90 and 3? 80 and 3?

4. How many are 10 less 3? 30 less 3? 20 less 3? 40 less 3? 60 less 3? 50 less 3? 70 less 3? 90 less 3? 80 less 3?

5. How many are 10 and 4? 30 and 4? 50 and 4? 40 and 4? 60 and 4? 80 and 4? 70 and 4? 90 and 4?

6. How many are 10 less 4? 30 less 4? 20 less 4? 50 less 4? 40 less 4? 60 less 4? 80 less 4? 70 less 4? 90 less 4?

7. How many are 10 and 5? 40 and 5? 60 and 5? 30 and 5? 70 and 5? 50 and 5? 80 and 5? 90 and 5?

8. How many are 10 less 5? 30 less 5? 20 less 5? 40 less 5? 60 less 5? 50 less 5? 70 less 5? 90 less 5? 80 less 5?

9. How many are 10 and 6? 40 and 6? 30 and 6? 50 and 6? 70 and 6? 60 and 6? 80 and 6? 90 and 6?

10. How many are 10 less 6? 30 less 6? 50 less 6? 20 less 6? 40 less 6? 60 less 6? 80 less 6? 70 less 6? 90 less 6?

11. How many are 10 and 7? 40 and 7? 20 and 7? 50 and 7? 30 and 7? 60 and 7? 80 and 7? 70 and 7? 90 and 7?

12. How many are 10 less 7? 30 less 7? 20 less 7?
40 less 7? 60 less 7? 50 less 7? 70 less 7? 90 less
7? 80 less 7?

13. How many are 20 and 8? 40 and 8? 60 and
8? 90 and 8? 80 and 8?

14. How many are 10 less 8? 30 less 8? 20 less 8?
60 less 8? 50 less 8? 70 less 8? 40 less 8? 90 less
8? 80 less 8?

15. How many are 20 and 9? 40 and 9? 60 and
9? 70 and 9? 90 and 9?

16. How many are 10 less 9? 30 less 9? 20 less
9? 40 less 9? 70 less 9? 50 less 9? 80 less 9?
60 less 9? 90 less 9?

LESSON XIII.

1. 9 and 3 are how many? 19 and 3? 29 and 3?
39 and 3? 49 and 3? 59 and 3? 69 and 3? 79
and 3? 89 and 3? 99 and 3?

2. 12 less 3 are how many? 22 less 3? 32 less 3?
42 less 3? 52 less 3? 62 less 3? 72 less 3? 82 less
3? 92 less 3?

3. 8 and 5 are how many? 18 and 5? 28 and 5?
38 and 5? 48 and 5? 58 and 5? 68 and 5? 78 and
5? 88 and 5? 98 and 5?

4. 13 less 5 are how many? 23 less 5? 33 less 5?
43 less 5? 53 less 5?

5. 6 and 6 are how many? 16 and 6? 36 and 6?
26 and 6? 46 and 6? 56 and 6? 86 and 6? 76 and
6? 96 and 6?

6. 12 less 6 are how many? 22 less 6? 32 less 6?
52 less 6? 42 less 6? 62 less 6? 72 less 6? 82 less
6? 92 less 6?

7. 7 and 7 are how many? 17 and 7? 27 and 7?
47 and 7? 37 and 7? 67 and 7? 57 and 7? 87
and 7? 77 and 7? 97 and 7?

8. 14 less 7 are how many? 24 less 7? 44 less 7?
34 less 7? 54 less 7? 64 less 7? 84 less 7? 74 less
7? 94 less 7?

9. 8 and 4 are how many? 18 and 4? 28 and 4?
38 and 4? 58 and 4? 48 and 4? 78 and 4? 68
and 4? 88 and 4? 98 and 4?

10. 12 less 4 leaves how many? 22 less 4? 42 less
4? 32 less 4? 52 less 4? 72 less 4? 82 less 4?
62 less 4? 92 less 4?

11. 9 and 5 are how many? 19 and 5? 39 and 5?
29 and 5? 49 and 5? 69 and 5? 59 and 5? 99
and 5? 89 and 5? 79 and 5?

12. 14 less 5 are how many? 24 less 5? 44 less 5?
64 less 5? 34 less 5? 54 less 6? 74 less 5? 84 less
5? 94 less 5?

13. 6 and 8 are how many? 16 and 8? 46 and 8?
36 and 8? 26 and 8? 56 and 8? 76 and 8? 66
and 8? 86 and 8? 96 and 8?

14. 16 less 8 are how many? 26 less 8? 46 less 8?
36 less 8? 66 less 8? 56 less 8? 76 less 8? 96 less
8? 86 less 8?

15. 6 and 9 are how many? 15 and 9? 35 and 9?
25 and 9? 45 and 9? 65 and 9? 55 and 9? 75 and
9? 85 and 9? 95 and 9?

16. 15 less 9 are how many? 25 less 9? 45 less 9?

35 less 9? 55 less 9? 75 less 9? 65 less 9? 85 less 8? 95 less 9?

17. 9 and 7 are how many? 16 and 7? 36 and 7? 26 and 7? 46 and 7? 66 and 7? 56 and 7? 86 and 7? 76 and 7? 96 and 7?

18. 16 less 7 are how many? 26 less 7? 46 less 7? 36 less 7? 56 less 7? 76 less 7? 86 less 7? 66 less 7? 96 less 7?

19. 7 and 8 are how many? 15 and 8? 25 and 8? 45 and 8? 35 and 8? 55 and 8? 75 and 8? 65 and 8? 85 and 8? 95 and 8?

20. 15 less 8 are how many? 25 less 8? 45 less 8? 35 less 8? 55 less 8? 65 less 8? 85 less 8? 75 less 8? 95 less 8?

21. 8 and 4 are how many? 18 and 4? 48 and 4? 38 and 4? 68 and 4? 58 and 4? 88 and 4? 78 and 4? 98 and 4?

22. 12 less 4 are how many? 32 less 4? 22 less 4? 52 less 4? 42 less 4? 62 less 4? 82 less 4? 72 less 4? 92 less 4?

23. 7 and 6 are how many? 17 and 6? 37 and 6? 27 and 6? 57 and 6? 47 and 6? 67 and 6? 97 and 6? 77 and 6? 87 and 6?

24. 23 less 6 are how many? 33 less 6? 53 less 6? 73 less 6? 63 less 6? 83 less 6? 93 less 6?

25. 9 and 8 are how many? 17 and 8? 27 and 8? 47 and 8? 37 and 8? 57 and 8? 77 and 8? 67 and 8? 87 and 8? 97 and 8?

26. 17 less 8 are how many? 27 less 8? 47 less 8? 37 less 8? 57 less 8? 87 less 8? 77 less 8? 67 less 8? 97 less 8?

LESSON XII.

TO TEACHERS.—This Lesson is intended as a "Drill Exercise" in adding and subtracting, and can not be made too familiar. Increased interest will be given to it, if occasionally the figures are written in a perpendicular or horizontal line upon the blackboard, the teacher pointing at each as the class name the results in concert.

1. Count by 2s till the sum is 50.* Thus: two, four, six, eight, ten, twelve, etc.

2. Count by 3s till the sum is 24. 36. 48.

3. Count by 4s till the sum is 24. 36. 48.

4. Count by 5s till the sum is 30. 40. 50.

5. Count by 6s till the sum is 24. 42. 60.

6. Count by 7s till the sum is 21. 35. 63.

7. Count by 8s till the sum is 24. 40. 64.

8. Count by 9s till the sum is 27. 45. 63.

9. Count by 10s till the sum is 50. 70. 100.

10. Begin at 50 and count backward by 2s. Thus: fifty, forty-eight, forty-six, forty-four, etc.

11. Begin at 48 and count backward by 3s.

12. Begin at 48 and count backward by 4s.

13. Begin at 50 and count backward by 5s.

14. Begin at 48 and count backward by 6s.

15. Begin at 49 and count backward by 7s.

16. Begin at 48 and count backward by 8s.

17. Begin at 45 and count backward by 9s.

18. Begin at 100 and count backward by 10s.

19. Add 7, and 2, and 5, and 3, and 8, and 4, and 6.

20. Add 8, and 3, and 6, and 4, and 7, and 5, and 2.

21. Add 9, and 4, and 3, and 6, and 7, and 8, and 5.

* This and the other numbers should be extended to 100 as soon as the progress of the class will warrant it.

MULTIPLICATION.

LESSON I.

TO TEACHERS.—The design of this Lesson is to develop the idea of "times," as used in Multiplication.

1. First boy hand me a counter, as a pencil. How many times have you passed a counter?

Ans. One time.

2. 1 time 1 counter is how many? "1 counter."

3. Pass me another counter. How many times have you now passed 1 counter?

Ans. Two times.

4. 2 times 1 counter are how many? "2 counters."

5. Next boy hand me another counter. How many times has 1 counter been handed me?

Ans. Three times.

6. How many are 3 times 1 pencil? "3 pencils."

7. Next, hand me another counter. How many times has 1 counter been handed me?

Ans. Four times.

8. How many are 4 times 1 hat? "4 hats."

9. Hand me 1 counter more. How many times has 1 counter been handed me?

Ans. Five times.

10. How many are 5 times 1 book? "5 books."

11. Pass another counter. How many times now?

Ans. Six times.

12. How many are 6 times 1 apple?

13. Pass another counter. How many times now?

Ans. Seven times.

LESSON II.

To TEACHERS.—The object of the next eight lessons is to make the class masters of the "Multiplication Table."

1. First pupil, make a *unit mark* upon the black-board; now make another on the right, with a space between them; as in the margin, * , *

2. How many times have you made 1 unit mark?

Ans. Two times.

3. How many are two times 1 unit? "Two."

4. Next pupil, make 2 unit marks, and on the right 2 more; as in the margin, * *, * *

5. How many times 2 unit marks have you?

Ans. Two times.

6. How many are 2 times 2 units? "Four."

7. Make 3 unit marks, and 3 unit marks.

* * *, * * *

8. How many times 3 unit marks are there?

Ans. Two times.

9. How many are 2 times 3 units? "Six."

The class may illustrate and complete the Table, as below:

2 times 1 are 2	2 times 7 are 14
2 times 2 are 4	2 times 8 are 16
2 times 3 are 6	2 times 9 are 18
2 times 4 are 8	2 times 10 are 20
2 times 5 are 10	2 times 11 are 22
2 times 6 are 12	2 times 12 are 24

1. What will 2 apples cost, at 1 cent each?

ANALYSIS.—If 1 apple costs 1 cent, 2 apples will cost 2 times 1 cent; and 2 times 1 cent are 2 cents. Therefore, 2 apples will cost 2 cents.

2. What will 2 peaches cost at 2 cents apiece?

3. Show me 2 times 2 fingers.
4. Lucia bought 2 yards of braid, at 3 cents a yard :
how much did she pay for her braid ?
5. Show me 2 times 3 fingers.
6. If lemons are 4 cents apiece, what will 2 cost ?
7. Show me 2 times 4 fingers.
8. If Howard can write a line in 5 minutes, how
long will it take him to write 2 lines ?
9. Show me 2 times 5 fingers.
10. If a man can saw a cord of wood in 6 hours, how
long will it take him to saw 2 cords ?
11. At 7 cents each, how much will 2 oranges cost ?
12. At 8 cents a quart, what will 2 quarts of chest-
nuts cost ?
13. If 1 inkstand costs 9 cents, what will 2 cost ?
14. What must I pay for 2 writing-books, at 10
cents apiece ?

LESSON III.

3 times 1 are 3	3 times 7 are 21
3 times 2 are 6	3 times 8 are 24
3 times 3 are 9	3 times 9 are 27
3 times 4 are 12	3 times 10 are 30
3 times 5 are 15	3 times 11 are 33
3 times 6 are 18	3 times 12 are 36

1. George bought 3 tops, at 4 cents apiece: how
much did he pay for his tops ?

ANALYSIS.—Since 1 top costs 4 cents, 3 tops must cost 3 times 4 cents; and 3 times 4 cents are 12 cents. Therefore, he paid 12 cents for his tops.

2. What will 3 caps cost, at 3 dollars each?
3. Show me by counters, that 3 times 3 are 9.
4. If you read 3 pages of history each day, how many pages will you read in 4 days?
5. Show me this by unit marks.
6. At 5 cents each, what cost 3 lemons?
7. George found 3 birds' nests, each of which had 5 eggs: how many eggs had they all?
8. Show this by unit marks.
9. What cost 3 yards of braid, at 6 cents a yard?
10. Show this by unit marks.
11. What cost 3 quarts of milk, at 8 cents a quart?
12. Show this by unit marks.
13. There are 7 days in 1 week: how many days are there in 3 weeks.
14. At 9 shillings a pair, how much will 3 pair of gloves come to?
15. At 10 cents a quart, what must I pay for 3 quarts of blackberries?
16. There are 12 months in 1 year: how many months are there in 3 years?
17. Multiply 6, 4, 8, 5, 7, 9, 11, 10, 12.
By 3, 3, 3, 3, 3, 3, 3, 3, 3.

 *Sight Exercises* may be employed with as much success in Multiplication as in the preceding rules. The digits should be written *promiscuously*, with sufficient space between to be readily distinguished. As the pointer is directed to one and another in quick succession, the answer should be given *instantly*, either by the class in concert, or by some individual, as deemed best by the teacher.

As soon as the *idea of times* is established in the minds of the class, they should learn to multiply abstract numbers from their knowledge of the Table independent of *counters*.

LESSON IV.

4 times 1 are 4	4 times 7 are 28
4 times 2 are 8	4 times 8 are 32
4 times 3 are 12	4 times 9 are 36
4 times 4 are 16	4 times 10 are 40
4 times 5 are 20	4 times 11 are 44
4 times 6 are 24	4 times 12 are 48

1. If 1 pen costs 2 cents, how much will 4 pens cost?
2. A hunter fired 4 shots, and killed 3 sparrows each time: how many sparrows did he kill?
3. Show by unit marks upon the blackboard which is the greater, 3 times 4, or 4 times 3.
4. At 5 shillings apiece, what will 4 rubber balls cost?
5. If a man walks 4 miles an hour, how far will he walk in 4 hours?
6. If my board costs me 6 dollars a week, what will it amount to in 4 weeks?
7. If you pay 8 cents a mile for stage-fare, what will it cost to ride 4 miles?
8. In 1 week there are 7 days: how many days are there in 4 weeks?
9. At 10 cents a pound, what cost 4 pounds of grapes?
10. If a tailor charges 9 dollars each for vests, what will he charge for 4 vests?
11. A milliner sold 4 hats, at 11 dollars apiece: what did they amount to?
12. If a rail-car goes at the rate of 12 miles an hour, how far will it go in 4 hours?
13. Multiply 5, 3, 7, 4, 6, 8, 10, 9, 11, 12.

By 4, 4, 4, 4, 4, 4, 4, 4, 4, 4.

LESSON . V.

5 times 1 are 5	5 times 7 are 35
5 times 2 are 10	5 times 8 are 40
5 times 3 are 15	5 times 9 are 45
5 times 4 are 20	5 times 10 are 50
5 times 5 are 25	5 times 11 are 55
5 times 6 are 30	5 times 12 are 60

1. At 2 shillings apiece, what will 5 melons cost?
2. If Jane gets 4 credit-marks a day, how many will she get in 5 days?
3. In a half-dime there are 5 cents: how many cents are there in 5 half-dimes?
4. If a man spends 3 shillings a day for cigars, how much will he spend in 5 days?
5. Which is the greater, 5 times 3, or 3 times 5?
6. When cider is 6 cents a quart, what will 5 quarts come to?
7. How many are 5 times 8 apples?
8. What cost 5 pen-holders, at 7 cents each?
9. A man sent 5 boxes of butter to market, each containing 12 pounds: how many pounds did he send?
10. What cost 5 bananas, at 10 cents apiece?
11. At 6 dollars apiece, what will 5 hats cost?
12. At 9 dollars a barrel, what cost 5 barrels of flour?
13. If I drive 11 miles an hour, how far shall I drive in 5 hours?
14. I have 5 young pear-trees; if they average 12 pears each, how many pears shall I have?
15. Multiply 6, 4, 8, 3, 7, 5, 10, 9, 11, 12:
By 5, 5, 5, 5, 5, 5, 5, 5, 5, 5.

LESSON VI.

6 times 1 are 6

6 times 2 are 12

6 times 3 are 18

6 times 4 are 24

6 times 5 are 30

6 times 6 are 36

6 times 7 are 42

6 times 8 are 48

6 times 9 are 54

6 times 10 are 60

6 times 11 are 66

6 times 12 are 72

1. A man gave 6 beggars 2 dollars apiece: how much did he give them all?

2. If you read 3 books every week, how many will you read in 6 weeks?

3. A farmer sold 6 sheep at 4 dollars a head: how much did he receive for his sheep?

4. Sarah has 6 cages, and 5 birds in each cage: how many birds has she?

5. A dairyman sent 6 boxes of butter to market, each box containing 8 pounds: how many pounds did all contain?

6. How many are 6 times 7 pounds?

7. At 9 cents a quart, how much will 6 quarts of cherries cost?

8. If Frank writes 6 lines a day, how many lines will he write in 6 days?

9. How many hours will a man work in 6 days, if he works 10 hours a day?

10. At 12 cents apiece, what cost 6 copy-books?

11. 6 times what are 18? 6 times what are 30? 24? 36? 48? 54? 66? 72?

12. Multiply 5, 3, 7, 4, 9, 6, 8, 11, 10, 12.

By 6, 6, 6, 6, 6, 6, 6, 6, 6

LESSON VII.

7 times 1 are 7	7 times 7 are 49
7 times 2 are 14	7 times 8 are 56
7 times 3 are 21	7 times 9 are 63
7 times 4 are 28	7 times 10 are 70
7 times 5 are 35	7 times 11 are 77
7 times 6 are 42	7 times 12 are 84

1. If Joseph earns 2 shillings a day, how many shillings will he earn in 7 days?

2. A traveler paid 4 dollars a day for board at a hotel: how much did he pay for 7 days?

3. In 1 yard there are 3 feet: how many feet are there in 7 yards?

4. At five dollars a gallon, what will 7 gallons of port wine come to?

5. If a man walks 6 miles an hour, how far will he walk in 7 hours?

6. What will 7 quarts of milk cost, at 8 cents a quart?

7. At 9 dollars each, what will 7 tables cost?

8. If 1 horse eats 10 quarts of oats in a day, how much will 7 horses eat?

9. If 1 stage carries 12 persons, how many persons will 7 stages carry?

10. A carpenter hired 7 laborers, at 11 dollars each per week: what was his weekly pay-roll?

11. 7 times what number are 28? 7 times what are 49? 42? 63? 84? 35? 56?

12. Multiply 6, 5, 9, 4, 8, 3, 7, 11, 10, 12.

By 7, 7, 7, 7, 7, 7, 7, 7, 7.

LESSON VIII.

8 times 1 are 8

8 times 2 are 16

8 times 3 are 24

8 times 4 are 32

8 times 5 are 40

8 times 6 are 48

8 times 7 are 56

8 times 8 are 64

8 times 9 are 72

8 times 10 are 80

8 times 11 are 88

8 times 12 are 96

1. A man bought 8 span of horses, 2 horses being a span: how many horses did he buy?

2. At 4 shillings a pair, what will 8 pair of mittens cost?

3. In a class of 8 pupils, each answered 5 questions: how many questions did they all answer?

4. What will Henry earn in 8 days, if he earns 6 shillings a day?

5. If 7 yards of velvet make a cloak, how many yards will be required to make 8 cloaks?

6. If cocoa-nuts are 7 cents apiece, what will be the cost of 8?

7. Bought 8 dolls, at 10 cents apiece: what did they cost?

8. If 1 settee will seat 12 pupils, how many will 8 seat?

9. If you give 8 beggars 11 cents apiece, how much will you give them all?

10. Which will cost the more, 7 quarts of cherries, at 8 cents a quart, or 9 quarts of cranberries, at 6 cents a quart?

11. 8 times what number are 40? 32? 48? 64?

12. Multiply 7, 4, 6, 3, 8, 5, 9, 11, 10, 12.

By 8, 8, 8, 8, 8, 8, 8, 8, 8, 8.

LESSON IX.

9 times 1 are 9	9 times 7 are 63
9 times 2 are 18	9 times 8 are 72
9 times 3 are 27	9 times 9 are 81
9 times 4 are 36	9 times 10 are 90
9 times 5 are 45	9 times 11 are 99
9 times 6 are 54	9 times 12 are 108

1. James bought nine pears, at 3 cents apiece: how many cents did they come to?
2. If a boy's suit requires 5 yards of cloth, how many yards will 9 suits require?
3. At 6 cents each, what cost 9 bananas?
4. In 1 window there are 4 panes of glass: how many panes in 9 windows?
5. What will 7 chairs cost, at 9 dollars each?
6. In 1 peck there are 8 quarts: how many quarts are there in 9 pecks?
7. If there are 9 pupils in a class, how many are there in 9 classes?
8. At 10 dollars a ton, what will be the cost of 9 tons of coal?
9. A man traveled 9 days on foot, and found he had walked 11 miles a day: how far was he from home?
10. Which is the greater, 9 times 7, or 8 times 8?
11. In a certain school there are 9 classes, and 12 scholars in a class: how many scholars are there in the school?
12. 9 times what are 27? 45? 63? 54? 72? 108?
13. Multiply 5, 4, 6, 3, 8, 7, 11, 9, 10, 12.
By 9, 9, 9, 9, 9, 9, 9, 9, 9, 9.

LESSON X.

10 times 1 are 10
 10 times 2 are 20
 10 times 3 are 30
 10 times 4 are 40
 10 times 5 are 50
 10 times 6 are 60

10 times 7 are 70
 10 times 8 are 80
 10 times 9 are 90
 10 times 10 are 100
 10 times 11 are 110
 10 times 12 are 120

1. How far will a man go in 10 hours, if he walks 3 miles an hour?
2. At 4 dollars a yard, what will 10 yards of silk cost?
3. In a sail-boat going 5 miles an hour, how far can you sail in 10 hours?
4. There are 7 days in a week: how many days in 10 weeks?
5. If there are 8 gold pieces in a pile, how many will there be in 10 piles?
6. How many trains of cars will pass a station in 10 days, if 8 trains pass each day?
7. If you plant 6 kernels of corn in a hill, how many kernels will it take to plant 10 hills?
8. Which is the greater, 10 times 8, or 9 times 9?
9. A merchant sold 10 yards of broadcloth to a customer, at 9 dollars a yard: what was the amount of the bill?
10. Which is the greater, 6 times 12, or 10 times 7?
11. What cost 10 gold rings, at 9 dollars apiece?
12. How many times 10 are equal to 10 times 12?
13. 10 times what are 60? 10 times what are 100? 90? 110? 120?
14. Multiply 7, 4, 6, 3, 8, 5, 9, 11, 10, 12.
 By 10, 10, 10, 10, 10, 10, 10, 10, 10, 10.

LESSON XI.

11 times 1 are 11

11 times 2 are 22

11 times 3 are 33

11 times 4 are 44

11 times 5 are 55

11 times 6 are 66

11 times 7 are 77

11 times 8 are 88

11 times 9 are 99

11 times 10 are 110

11 times 11 are 121

11 times 12 are 132

1. In 1 gallon there are 4 quarts: how many quarts are there in 11 gallons?

2. At 6 dollars a yard, what will 11 yards of broad-cloth come to?

3. In a half-dime there are 5 cents: how many cents are there in 11 half-dimes?

4. How much will 11 citron melons cost, at 8 cents apiece?

5. In 1 week there are 6 working-days: how many working-days are there in 11 weeks?

6. How many flowers are there in 11 vases, if each vase contains 9 flowers?

7. Which is more, 11 times 8, or 7 times 12?

8. A farmer sold 11 tons of hay, at 10 dollars a ton: how much did he receive for his hay?

9. Which is the longer distance, 8 times 9 feet, or 11 times 7 feet?

10. What cost 11 pounds of maple-sugar, at 12 cents a pound?

11. 11 times what are 77? 11 times what are 99? 121? 110? 132?

12. Multiply 6, 3, 7, 5, 9, 4, 8, 11, 10, 12.

By 11, 11, 11, 11, 11, 11, 11, 11, 11, 11.

LESSON XII.

12 times 1 are 12

12 times 2 are 24

12 times 3 are 36

12 times 4 are 48

12 times 5 are 60

12 times 6 are 72

12 times 7 are 84

12 times 8 are 96

12 times 9 are 108

12 times 10 are 120

12 times 11 are 132

12 times 12 are 144

1. If it takes 4 hours to cut a ton of ice from a pond, how long will it take to cut 12 tons?

2. If Frank can skate 5 miles an hour, how far can he skate in 12 hours?

3. George has 6 hens, and 12 times as many chickens as hens: how many chickens has he?

4. What is the weight of 12 turkeys, if they average 11 pounds apiece?

5. At 7 dollars a bushel, what will 12 bushels of clover-seed cost?

6. What will be the cost of 12 dresses, if each dress costs 9 dollars?

7. On a holiday excursion there were 12 sleighs, having 9 children in each: how many children were there in all?

8. Which is the greater, 12 times 7, or 9 times 9?

9. Which is the greater, 12 times 10, or 11 times 11?

10. In 1 shilling there are 12 pence: how many pence are there in 12 shillings?

11. 12 times what are 48? 12 times what are 72? 96? 84? 120? 108? 132? 144?

12. Multiply 7, 3, 6, 5, 8, 4, 9, 11, 10, 12.

By 12, 12, 12, 12, 12, 12, 12, 12, 12, 12.

LESSON XIII.

1. What is Multiplication?

Ans. Multiplication is finding the amount of a number taken or added to itself, a given number of times.

2. What is the number to be multiplied called?

Ans. The Multiplicand.

3. What the number by which you multiply?

Ans. The Multiplier.

4. What is the number obtained by mult. called?

Ans. The Product.

5. When it is said that 5 times 9 are 45, which is the multiplicand? The multiplier? The product?

6. When it is said that 6 times 7 are 42, what is the 6 called? The 7? The 42?

7. What is the product of 7 multiplied by 5?

8. What is the product of 8 multiplied by 4?

9. If 6 is multiplied by 8, what is the product?

10. If 9 is multiplied by 7, what is the product?

11. What will 3 quarts of cherries cost, at 9 cents a quart?

ANALYSIS.—Three quarts will cost 3 times as much as 1 quart; and 3 times 9 cents are 27 cents. Therefore, 3 quarts will cost 27 cents.

12. A teacher has 4 classes, each class containing 8 pupils: how many pupils has he?

13. How many times 2 are 12? How many times 3? How many times 4? How many times 6?

14. How many times 9 are 18? How many times 6? How many times 2? How many times 3?

15. How many times 4 are 24? How many times 3? How many times 6? How many times 2? How many times 8? How many times 12?

16. Louise bought 6 yards of braid, at 7 cents a yard: how much did she pay for it?

17. If 5 boys can sit on 1 bench, how many can sit on 6 benches?

18. How many times 4 are 28? How many times 7?

19. Which is the greater, 3 times 8, or 6 times 4?

20. Which is the greater, 9 times 3, or 4 times 7?

21. At 6 shillings a pair, what cost 5 pair of skates?

22. Walking 4 miles an hour, how far will a man walk in 8 hours?

23. How many times 5 are 20? 30? 25? 35? 50? 45? 60?

24. How many times 6 are 30? How many times 10? How many times 5? How many times 3?

25. Which is the greater, 3 times 11, or 4 times 8?

26. Which is the greater, 9 times 4, or 6 times 6?

27. In a garden there are 5 rows of peach trees, with 7 trees in a row: how many peach trees does the garden contain?

28. At 10 cents a quart, what cost 6 quarts of chestnuts?

29. How many times 7 make 35? How many times 5?

30. How many times 5 make 40? How many times 4? How many times 8? How many times 10?

31. In 1 bouquet there are 8 flowers: how many flowers are there in 4 bouquets?

32. What will 10 chickens cost, at 3 shillings each?

33. What will be a man's expenses for 7 days, if he spends 5 dollars a day?

34. How many times 6 are 24? 42? 36? 48? 54? 60? 72?

35. How many times 8 make 48? How many times 4? How many times 6? How many times 12?

36. In 1 week there are 7 days: how many days in 4 weeks?

37. In 1 dime there are 10 cents: how many cents in 6 dimes?

38. At 4 dollars a pair, what will be the cost of 6 pair of boots?

39. How many times 7 are 42? 35? 28? 56 49? 63? 77? 70? 84?

40. Which is the greater, 9 times 5, or 6 times 8?

41. What will 7 bibles cost, at 3 dollars apiece?

42. Which will cost the more, 6 oranges at 4 cents, or 9 lemons at 3 cents apiece?

43. How many times 8 are 32? 24? 40? 56? 48? 64? 88? 72? 96?

44. How many times 9 make 54? How many times 6?

45. Which will cost the more, 4 slates at 9 cents, or 6 inkstands at 6 cents apiece?

46. If 1 woman can make 4 vests in a week, how many vests can 7 women make?

47. If Helen writes 8 lines a day, how many lines will she write in 5 days?

48. How many times 6 make 72? How many times 8? How many times 12? How many times 9?

49. John paid 12 cents apiece for 3 melons, and Henry 4 cents apiece for 10 cigars: which spent the more money?

50. How many times 9 are 36? 27? 45? 63? 54? 81? 72? 99? 108?

51. How much will 7 pair of chickens weigh, at 6 pounds a pair?

52. George's father gave him and his 7 brothers 5 dollars each: how much did he give them all?

53. Ida bought 3 spools of cotton, at 8 cents a spool, and 5 yards of tape, at 2 cents a yard: how much did she pay for both?

54. Harriet bought 6 yards of narrow ribbon, at 7 cents a yard, and handed the clerk a fifty-cent piece: how much change ought she to receive?

55. How many pounds of butter can be packed in 6 jars, each jar holding 12 pounds?

56. What is the cost of 5 dozen eggs, at 12 cents a dozen, and 4 quarts of molasses, at 10 cents a quart?

57. A housekeeper bought 10 quarts of cranberries, at 9 cents a quart: what did they come to?

58. In 1 gallon there are 4 quarts: how many quarts are there in 11 gallons?

59. In 1 peck there are 8 quarts: how many quarts are there in 3 pecks of chestnuts?

60. A man bought 9 tons of coal, at 7 dollars a ton, and paid 60 dollars: how much did he owe for it?

DIVISION.

LESSON I.

TO TEACHERS.—The object of this Lesson is to develop the idea of “times,” as used in Division.

1. Here are 2 counters. (The Teacher holding up 2 visible objects, as books, pencils, etc.) If I pass one of them to you, how many will be left? “One.”

2. If I pass another, how many will be left? “None.”

3. How many times have I passed one counter?

Ans. Two times.

4. How many times is one counter contained in two counters?

5. Here are 3 oranges in a fruit-dish; if I take out one, how many are left? “Two.”

6. If I take 1 more, how many are left? “One.”

7. If I take 1 more, how many are left? “None.”

8. How many times have I taken out 1 orange?

Ans. Three times.

9. How many ones are there in 3? “3 ones.”

10. Here are 4 marbles; if I give 1 marble to the first boy, 1 to the second, 1 to the third, and 1 to the fourth, how many will be left? “None.”

11. How many times have I given one marble?

Ans. Four times.

12. Here are 5 pencils; if I give 1 to each, how many pupils can I supply?

Ans. You can supply as many pupils as you have pencils, which is 5.

LESSON II

To TEACHERS.—The object of this Lesson is to secure familiarity with the construction of the "Division Table."

1. First pupil, make 2 unit marks upon the black-board, as in the margin, * *

How many groups of 2 marks are there?

"1 group."

2. How many times is 2 contained in 2?

Ans. One time.

3. Make 4 unit marks in groups of 2 marks each, as in the margin, **, **

How many groups are there now?

"2 groups."

4. How many twos make 4? "2 twos."

How many times is 2 contained in 4?

Ans. Two times.

5. Make 6 unit marks in groups of 2 marks each, as in the margin, **, **, **

How many groups are there now?

"3 groups."

6. How many twos make 6? "3 twos."

How many times is 2 contained in 6?

Ans. Three times.

7. Make 8 unit marks in groups of 2 marks each, as in the margin, **, **, **, **

How many groups are there now?

How many twos make 8? "4 twos."

How many times is 2 contained in 8?

Ans. Four times.

 Let the class now illustrate and complete the Table.

LESSON III.

2 in 2, 1 time	2 in 12, 6 times
2 in 4, 2 times	2 in 14, 7 times
2 in 6, 3 times	2 in 16, 8 times
2 in 8, 4 times	2 in 18, 9 times
2 in 10, 5 times	2 in 20, 10 times

1. If 1 pear can be bought for 2 cents, how many pears can be bought for 4 cents?

ANALYSIS.—If two cents will buy one pear, 4 cents will buy as many pears as 2 cents are contained times in 4 cents; and 2 cents are in 4 cents, 2 times. Therefore, 4 cents will buy 2 pears.

2. At 2 cents apiece, how many bananas can you buy for 8 cents?

Show this by your fingers.

3. If I have 6 pencils, how many pupils can I supply with 2 pencils each? Show this.

4. At 2 cents apiece, how many oranges can you buy for 10 cents? Show this by your fingers.

5. How many lemons can I buy for 12 cents, if I pay 2 cents for each? Show this by counters.

6. If I have 16 roses, how many children can I supply with 2 roses apiece? Show this.

7. If Henry can walk a mile in 2 hours, how far can he walk in 20 hours?

8. If I pay 2 cents each for pears, how many can I buy for 18 cents?

9. If you read a page in 1 minute, how many pages can you read in 20 minutes?

10. Copy and divide the following:

2) 8, 14, 12, 16, 18, 20, 22, 24.

LESSON IV.

3 in 3, 1 time	3 in 18, 6 times
3 in 6, 2 times	3 in 21, 7 times
3 in 9, 3 times	3 in 24, 8 times
3 in 12, 4 times	3 in 27, 9 times
3 in 15, 5 times	3 in 30, 10 times

1. A farmer divided 12 apples equally among 3 girls: how many apples did each receive?

ANALYSIS.—Since 12 apples were divided equally among 3 girls, each received 1 apple as often as 3 is contained times in 12; and 3 is in 12, 4 times. Therefore, each girl received 4 apples.

2. A father divided 6 oranges equally among his 3 children: how many did he give to each?

3. William divided 9 almonds equally among his 3 sisters: how many did he give to each?

4. At 3 cents a spool, how many spools of cotton can a lady buy for 21 cents?

Show this by counters.

5. If you gain 3 credits a day, how many days will it take you to gain 15 credits? Show it.

6. When thimbles are 3 cents each, how many can be bought for 18 cents?

7. How long will it take a child to learn 24 letters, if he learns 3 letters a day?

8. If a carpenter earns 3 dollars a day, how long will it take him to earn 27 dollars?

9. A vessel sailed 30 miles in 3 hours: how many miles did she sail per hour?

10. Copy and divide the following:

3) 15, 21, 18, 27, 24, 30, 33, 36.

LESSON V.

4 in 4, 1 time	4 in 24, 6 times
4 in 8, 2 times	4 in 28, 7 times
4 in 12, 3 times	4 in 32, 8 times
4 in 16, 4 times	4 in 36, 9 times
4 in 20, 5 times	4 in 40, 10 times

1. A teacher having 12 peaches, divided them equally among 4 scholars: how many did each receive?

2. At 4 dollars apiece, how many hats can be bought for 20 dollars?

3. In 4 quarts there is 1 gallon: how many gallons are there in 16 quarts?

4. Theodore sold 4 quarts of strawberries for 24 cents: how much did he receive a quart?

5. Thirty-two is how many times 4? * 28 is how many times 4?

6. If 4 pounds of coffee last a family a month, how long will 28 pounds last them?

7. If a man walks 4 miles an hour, how many hours will it take him to walk 36 miles?

8. If a person pays 4 dollars a week for his board, how long can he board for 40 dollars?

9. In 1 pint there are 4 gills: how many pints are there in 36 gills?

10. At 4 dollars apiece, how many satchels can be bought for 28 dollars?

11. Copy and divide the following:

4) 20, 28, 24, 32, 36, 40, 44, 48.

* Abstract numbers in this and similar cases are considered as *collective* nouns, conveying the *idea of unity*; hence a *singular* verb is used.

LESSON VI.

5 in 5, 1 time	5 in 30, 6 times
5 in 10, 2 times	5 in 35, 7 times
5 in 15, 3 times	5 in 40, 8 times
5 in 20, 4 times	5 in 45, 9 times
5 in 25, 5 times	5 in 50, 10 times

1. If it takes 5 yards of ribbon to trim 1 bonnet, how many bonnets will 15 yards trim?
2. How many clocks, worth 5 dollars apiece, can be bought for 20 dollars?
3. James spent 25 cents for lemons, which were 5 cents each: how many did he buy?
4. Allowing 5 yards to a cloak, how many cloaks can be made with 30 yards of velvet?
5. If 5 pounds of butter last a family a week, how long will 40 pounds last them?
6. A man distributed 35 pounds of flour among 5 poor families: how much did each family receive?
7. At 5 dollars a cord, how many cords of wood can you buy for 35 dollars?
8. How many pews will it take to seat 50 persons, allowing 5 persons to a pew?
9. How many times 5 make 20? 15? 30? 25? 35? 40? 50? 45?
10. If I divide 45 marbles equally among 5 boys, how many will each receive?
11. A poor family has 40 pounds of flour: how long will it last them if they use 5 pounds a week?
12. Copy and divide the following:
5) 20, 35, 30, 40, 45, 50, 55, 60.

LESSON VII.

6 in 6, 1 time	6 in 36, 6 times
6 in 12, 2 times	6 in 42, 7 times
6 in 18, 3 times	6 in 48, 8 times
6 in 24, 4 times	6 in 54, 9 times
6 in 30, 5 times	6 in 60, 10 times

1. If flour is 6 dollars a barrel, how many barrels can you buy for 24 dollars?
2. Show this upon the blackboard.
3. When stage-fare is 6 cents a mile, how far can a man ride for 36 cents?
4. Julia paid 18 cents for 6 papers of needles: how much was that a paper?
5. A teacher paid 42 cents for 6 inkstands: how much was that apiece?
6. A hunter fired 6 times into a flock of wild pigeons, and found 30 lying on the ground: what was the average number killed at a shot?
7. Ada has 42 figs, which she wishes to give to her 6 brothers: how many can she give to each?
8. A school containing 54 pupils was divided into 6 classes: how many were there in a class?
9. How many tons of ice, at 6 dollars a ton, can be bought for 48 dollars?
10. At 6 cents a quart, how many peas can you buy for 60 cents?
11. How many are 6 times 7? 6 times 4? 5? 3? 6? 10? 8? 9?
12. Copy and divide the following:
6) 24, 36, 30, 48, 42, 54, 66, 72.

LESSON VIII.

7 in 7, 1 time	7 in 42, 6 times
7 in 14, 2 times	7 in 49, 7 times
7 in 21, 3 times	7 in 56, 8 times
7 in 28, 4 times	7 in 63, 9 times
7 in 35, 5 times	7 in 70, 10 times

1. How many drums of figs, at 7 shillings a drum, can be bought for 21 shillings?

2. Emily picked 28 flowers, which she arranged in bouquets of 7 flowers each: how many bouquets did she make?

3. How many baskets will 42 oranges fill, each basket holding 7 oranges?

4. How many yards of velvet, at 7 dollars a yard, can be purchased for 35 dollars?

5. In 1 week there are 7 days: how many weeks are there in 49 days?

6. A confectioner has 56 ounces of sugar plums: how many horns of plenty, each holding 7 ounces, can he fill?

7. George paid 63 cents for riding 7 miles in a stage: what was that a mile?

8. A dairyman has 70 pounds of butter, which he proposes to pack in jars, each holding 7 pounds: how many jars will he require?

9. Harry read 49 chapters in 7 weeks: how many chapters did he read per week? How many per day?

10. How many are 7 times 5? 7 times 4? 3? 6? 8? 7? 9? 10?

11. Copy and divide the following:

7) 35, 28, 42, 56, 49, 63, 77, 84

LESSON IX.

8 in 8, 1 time	8 in 48, 6 times
8 in 16, 2 times	8 in 56, 7 times
8 in 24, 3 times	8 in 64, 8 times
8 in 32, 4 times	8 in 72, 9 times
8 in 40, 5 times	8 in 80, 10 times

1. A man having 32 acres of land, divided it into fields of 8 acres each: how many did he make?

2. At 8 dollars a ton, how many tons of coal can be bought for 24 dollars?

3. How many boxes of raisins are there in 40 pounds, allowing 8 pounds to a box?

4. Richard sold a quantity of filberts for 48 cents, which was 8 cents a quart: how many quarts did he sell?

5. A teacher having 56 pencils, divided them among 8 classes: how many did each class receive?

6. A military company of 64 men was divided into platoons of 8 men each: how many platoons were there?

7. A pleasure party of 72 persons chartered 8 yachts: how many sailed in each?

8. How many baskets will it take to hold 56 eggs, if you put 8 in a basket?

9. At 8 cents a pound, how many pounds of sugar can you buy for 72 cents?

10. How many are 8 times 4? 8 times 6? 4? 7?
5? 8? 9? 10?

11. Copy and divide the following:

8) 32, 48, 64, 56, 72, 80, 88, 96.

LESSON X.

9 in 9, 1 time	9 in 54, 6 times
9 in 18, 2 times	9 in 63, 7 times
9 in 27, 3 times	9 in 72, 8 times
9 in 36, 4 times	9 in 81, 9 times
9 in 45, 5 times	9 in 90, 10 times

1. A farmer sold 9 lambs for 18 dollars : how much was that apiece ?
2. George distributed 27 apples among 9 classmates : how many did each have ?
3. If a horse trots 9 miles an hour, how many hours will it take him to trot 45 miles ?
4. At 9 cents a quart, how many quarts of cherries can be bought for 36 cents ?
5. If you solve 9 examples a day, how many days will it take you to solve 54 examples ?
6. Samuel spent 63 cents for 9 cigars : how much did he pay for each ?
7. Carrie read 72 pages in 9 days : how many pages was that per day ?
8. At 9 dollars a ton, how many tons of hay can be bought for 81 dollars ?
9. A dairy-woman made 9 cheeses, which weighed 90 pounds : what was their average weight ?
10. If you divide a farm of 72 acres into lots of 9 acres, how many lots will you have ?
11. How many are 9 times 3 ? 9 times 5 ? 4 ? 6 ? 8 ? 7 ? 9 ? 10 ?
12. Copy and divide the following :
9) 36, 54, 72, 63, 81, 90, 99, 108.

LESSON XI.

10 in 10, 1 time	10 in 60, 6 times
10 in 20, 2 times	10 in 70, 7 times
10 in 30, 3 times	10 in 80, 8 times
10 in 40, 4 times	10 in 90, 9 times
10 in 50, 5 times	10 in 100, 10 times

1. How many pineapples, at 10 cents apiece, can I buy for 30 cents?
2. If 10 masons earn 40 dollars in 1 day, what will one mason earn?
3. Horace sold chestnuts at 10 cents a quart, and received 50 cents: how many did he sell?
4. Susan plucked 60 roses from 10 bushes: how many was that from each bush?
5. A farmer sold 10 bushels of wheat for 20 dollars: what did he get a bushel?
6. I have 70 peach trees, which I wish to set in rows of 10 each: how many rows will they make?
7. In 1 dime there are 10 cents: how many dimes are there in 80 cents?
8. At 10 shillings a gallon, how many gallons of oysters can be had for 90 shillings?
9. If 80 policemen are divided equally into 10 squads, how many will there be in each squad?
10. If flour is 10 dollars a barrel, how many barrels can be bought for 100 dollars?
11. How many are 10 times 4? 10 times 3? 5? 7? 6? 9? 8? 10?
12. Copy and divide the following:
10) 40, 60, 50, 80, 70, 90, 100, 110.

LESSON XII.

1. What is Division ?

Ans. Division is finding how many times one number is contained in another.

2. What is the number to be divided called ?

Ans. The Dividend.

3. The number to divide by ?

Ans. The Divisor.

4. What is the number found by division called ?

Ans. The Quotient.

5. What is the number sometimes left after division called ?

Ans. The Remainder.

6. When we say 5 is contained in 17, 3 times and 2 over, which is the dividend ? Which the divisor ? Which the quotient ? Which the remainder ?

7. When we say 3 is contained in 19, 6 times and 1 over, what is the 3 called ? The 19 ? The 6 ? The 1 ?

8. How many times is 2 contained in 13, and how many over ?

9. How many oranges, at 4 cents each, can you buy for 22 cents ; and how many cents will you have left ?

10. At 3 cents apiece, how many sticks of candy can you buy for 25 cents, and how much change will you have left ?

11. How many times can you fill a gallon measure, which holds 4 quarts, from a tank holding 36 quarts ?

12. At 5 cents apiece, how many oranges can you buy for 35 cents?

13. How many times 4 in 33, and how many over?
In 28? 43? 26? 21? 44? 48? 50?

14. If you ride at the rate of 6 miles an hour, how long will it take you to ride 30 miles?

15. How many quarts of raspberries, at 7 cents a quart, can I buy for 42 cents?

16. How many times 5 are 20? 35? 48? 45?
32? 49? 51?

17. Bought 6 calves for 42 dollars: what was that apiece?

18. If 1 barrel of flour can be made from 4 bushels of wheat, how many barrels can be made from 48 bushels?

19. If you pay 50 dollars for 5 weeks' board, what will that be per week?

20. 24 is how many times 6? How many times 4?
How many times 2? Times 3? Times 8? Times 12?

21. If a man is 45 miles from home, and walks 5 miles an hour, how long will it take him to reach home?

22. How many times 6 are 30? 42? 24? 36?
48? 44? 54? 60?

23. If you divide 48 apples equally among 6 of your companions, how many will you give to each?

24. A grocer sold 56 pounds of sugar, putting it up in packages of 7 pounds each: how many packages did he make?

25. How many dresses containing 9 yards each, can be made from 45 yards of cashmere?

26. 48 is how many times 8? How many times 4?
How many times 6?

27. In my orchard are 54 trees, and 9 trees in a row: how many rows are there?

28. If a man gives 60 peaches to 10 boys, how many will each have?

29. 36 is how many times 6? How many times 9?
How many times 4? How many times 12?

30. 55 is how many times 5? How many times 11?

31. If 7 bushels of apples will make 1 barrel of cider, how many barrels will 49 bushels make?

32. How long will 63 pounds of butter last a family, if they use 7 pounds a week?

33. If there are 9 persons in the above family, how many pounds will that be for each person?

34. If a car-wheel turns round once in going 9 feet, how many times will it turn in 72 feet?

35. If a man makes 6 rods of wall per day, how long will it take him to make 54 rods?

36. A man having 56 horses, put them into 7 stables: how many did he put in a stable?

37. When coal is 8 dollars a ton, how many tons can be bought for 64 dollars?

38. A farmer picked 72 bushels of apples from 8 trees: how many bushels was that to a tree?

39. When cider is 9 cents a quart, how many quarts can you buy for 90 cents?

40. At 10 dollars a pair, how many pair of pants can you buy for 100 dollars?

41. If Sarah divides 81 lozenges among 9 companions, how many will she give to each?

QUESTIONS FOR REVIEW.

4. 1. Josephine cut 3 roses from one bush, 5 from another, and 7 from another: how many did she cut from all?

2. William paid 8 cents for an inkstand, 10 cents for a slate, and 7 cents for a sponge: how much did he pay for all?

3. George having 25 cents, paid 8 cents for a writing-book: how much change did he have left?

4. How many are 10 flowers, and 12 flowers, and 6 flowers?

5. A beggar obtained 10 cents from one person, and 12 from another; and then spent 6 cents for a glass of liquor: how many cents did he have left?

6. How many are 5, and 7, and 6, and 3?

7. A lady spent 7 shillings for a pair of gloves, and 6 shillings for a pocket-handkerchief, and had 12 shillings left: how much had she at first?

8. On New-Year's day, Charles received 7 cents from his uncle, and 12 cents from his father; on his way to school he lost 5 of them: how many had he left?

9. How many are 8, and 7, and 6, less 10?

10. How many are 9, and 4, and 7, less 8?

11. A farmer having 21 sheep, lost 3 of them, and sold 5: how many had he then?

12. Augustus had 12 marbles and lost 3; Henry had 5 marbles and gained 2: how many more marbles had Augustus than Henry?

* Dictation Exercises for the slate and blackboard, are recommended in connection with the Questions for Review.

13. George having 18 apples, gave 4 to his brother, and 5 to his sister: how many did he have left?

14. Amelia gained 8 credits for perfect lessons, and 6 for good behavior, but lost 4 for tardiness: how many had she at the close of the day?

15. How many are 32, and 7, and 3, less 12?

16. How many are 45, less the sum of 6 and 3?

17. How many are 31 and 7, less the sum of 4 and 6?

18. From the sum of 12 and 10, take the sum of 3 and 4.

19. Eugenie having 40 flowers, put 15 in one bouquet, 10 in another, and 8 in another: how many flowers were left?

20. John spent 10 cents for peanuts, 7 cents for sweet cider, 8 cents for pears, and lost 5 cents, which was all his money: how much had he at first?

B. 1. Henrietta had 30 chestnuts, and her brother gave her 20 more: how many did she then have?

ANALYSIS.—30 is the same as 3 tens, and 20 the same as 2 tens; but 3 tens and 2 tens are 5 tens, or 50. Therefore, she had 50 chestnuts.

2. How many tens in 40? In 50?

3. How many tens in 70? In 60? In 80? In 90?

4. How many tens in 100? In 110? In 120?
130? 150?

5. 3 tens are how many? 5 tens? 4 tens?

6. 6 tens are how many? 8 tens? 9 tens?

7. 10 tens are how many? 11 tens? 12 tens?

8. 4 tens and 5 tens are how many?

9. 6 tens and 7 tens are how many?
10. 8 tens and 9 tens are how many?
11. How many are 30 dollars and 40 dollars?
12. How many are 50 apples and 50 apples?
13. Homer earned 40 cents in one day, and 30 cents the next: how much did he earn in both days?
14. Susan paid 50 cents for an Arithmetic, and 30 cents for a Reader: how much did she pay for both?
15. A man received 60 cents for doing a job, and paid 20 cents for a lunch: how many cents did he have left?

ANALYSIS.—60 is 6 tens, and 20 is 2 tens; now 2 tens from 6 tens leave 4 tens, or 40. Therefore, he had 40 cents left.

16. If you have 80 cents, and pay 50 cents for a History, how much will you have left?
17. George paid 60 cents for a knife, and sold it for 40 cents: how much did he lose by his bargain?
18. If you take 30 from 50, how many will be left?
19. 40 taken from 70, leaves how many?
20. 60 taken from 100, leaves how many?
21. On one of my trees there are 24 peaches, and on another 38 peaches: how many peaches have I?

ANALYSIS.—24 is 2 tens and 4 units; 38 is 3 tens and 8 units; now 2 tens and 3 tens are 5 tens, or 50; 4 units and 8 units are 12 units, which, added to 50, make 62. Therefore, I have 62 peaches.

22. What is the sum of 25 and 36?
23. What is the sum of 38 and 45?
24. What is the sum of 54 and 42?
25. A man paid 45 dollars for a cow, and 23 dollars for a ton of hay: how much did he pay for both?

8) QUESTIONS FOR REVIEW.

26. If a dairy-woman makes 58 pounds of butter in one week, and 46 the next, how many pounds does she make in two weeks?

27. If there are 36 panes of glass in one window, and 48 in another, how many are there in both windows?

28. What is the sum of 61 and 75?

29. What is the sum of 85 and 63?

30. How many are 95 and 44?

31. A man has two farms, containing 106 acres and 64 acres respectively: how many acres do both contain?

32. A man is 86 years old, and his wife 75 years: what is the sum of their ages?

33. James having 45 cents, paid 21 cents for a speller: how many cents change had he?

ANALYSIS.—45 is 4 tens and 5 units; 21 is 2 tens and 1 unit. Now 2 tens from 4 tens leave 2 tens, or 20, and 1 unit from 5 units leaves 4 units, which, added to 20, make 24. Therefore, he had 24 cents change.

34. 24 from 37 leaves how many?

35. 31 from 43 leaves how many?

36. 45 from 68 leaves how many?

37. Arthur having 65 cents, paid 25 cents for a kite: how many cents had he left?

38. A man having 76 miles to travel, went 33 miles the first day: how many miles remained?

39. If I buy a reader for 85 cents, and sell it for 60 cents, how much shall I lose?

40. Hattie read 68 pages in a day, and her brother 52 pages: how many more pages did she read than her brother?

C. 1. What will 7 cords of wood cost, at 6 dollars a cord?

ANALYSIS.—7 cords will cost 7 times as much as 1 cord, and 7 times 6 dollars are 42 dollars. Therefore, 7 cords will cost 42 dollars.

2. At 8 dollars apiece, what will 6 desks cost?

3. Horatio meeting 4 beggars, gave 10 cents to each: how much did he give to all?

4. Floretta had a present of 5 bouquets, each having 12 japonicas: how many japonicas were there in all?

5. A butcher sold a leg of venison weighing 11 pounds, at 8 cents a pound: what did it come to?

6. A nursery-man sold 9 pear-trees, at 3 dollars apiece: how much did he receive for them?

7. If a ship sails 6 miles an hour, how far will she sail in 7 hours?

8. What will 8 acres of land cost, at 10 dollars an acre?

9. What will 7 primers cost, at 9 cents apiece?

10. If you read 12 pages a day, how many pages will you read in 6 days?

11. If 1 horse eats 8 quarts of oats in a day, how many quarts will 7 horses eat?

12. A father gave to each of 8 children a book costing 9 dollars for a Christmas present: how much did all the books cost?

13. In one eagle there are 10 dollars: how many dollars in 11 eagles?

14. A teacher has 8 classes, of 12 pupils each: how many pupils attend the school?

15. How many trees in an orchard which has 8 rows, and 9 trees in a row?

16. At 11 shillings a pound, what will a canister of tea containing 9 pounds cost?

17. A gardener set out 12 trees a day for 9 days: how many trees did he set out in all?

18. If 11 trains of cars pass a station every day, how many trains will pass in 10 days? How many will pass in 12 days?

19. If a man can weave 10 yards of carpet in a day, how many yards can he weave in 12 days?

20. In 1 shilling there are 12 pence: how many pence are there in 12 shillings?

21. If a bag of coffee will last a family of 6 persons 12 weeks, how long will it last one person?

ANALYSIS.—It will last 1 person 6 times as long as 6 persons, and 6 times 12 weeks are 72 weeks.

22. If 8 men can do a job of work in 6 days, how long will it take one man to do it?

23. If it requires 7 men 9 weeks to finish a house, how long will it take one man?

24. If a quantity of hay will last 6 horses 8 weeks, how long will it last one horse?

25. If Florence can read a book through in 6 days, by reading 5 hours per day, how long will it take her if she reads 1 hour a day?

26. John can earn 12 dollars in 6 days, by working 8 hours a day: how long will it take him to earn the same, if he works 1 hour a day?

27. If 7 boys can pile a shed full of wood in 6 days, how long would it take 1 boy to fill it?

28. A man finds he can reach home in 9 hours by traveling 6 miles an hour; but being disabled, he could travel only 1 mile an hour: how long was he in getting home?

29. If 9 men can do a job of work in 7 days, how long will it take 1 man to do it?

30. If it takes 12 men 9 days to earn a certain sum, how long will it take 1 man to earn the same sum?

31. If a man has 3 trees, and each tree bears 30 peaches, how many peaches will he have?

ANALYSIS.—30 is 3 tens, and 3 times 3 tens are 9 tens, or 90. Therefore, he will have 90 peaches.

32. At 40 dollars a ton, what will 2 tons of hemp cost?

33. A man sold 4 acres of land, at 30 dollars an acre: what did he receive for his land?

34. A prima donna received 5 bouquets, each containing 50 flowers: how many flowers did she have?

35. At 60 dollars a ton, what is the cost of 4 tons of iron?

36. A farmer sold 4 cows at 36 dollars a head: what did he receive for them?

ANALYSIS.—36 is 3 tens and 6 units; now 4 times 3 tens are 12 tens, or 120, and 4 times 6 units are 24 units, which, added to 120, make 144. Therefore, he received 144 dollars.

37. At 23 cents each, what will 4 melons cost?

38. What cost 5 overcoats, at 48 dollars each?

39. If the rent of a house is 35 dollars a month, what will be the rent for 6 months?

40. If a man travel 67 miles a day, how far will he travel in 5 days?

D. 1. At 8 cents apiece, how many rubber balls can be bought for 56 cents?

ANALYSIS.—Since 8 cents will buy 1 ball, 56 cents will buy as many balls as 8 cents are contained times in 56 cents, which are 7 times. Therefore, 56 cents will buy 7 balls.

2. William met 5 beggars, to whom he gave 35 cents: how much did he give to each?

3. At 10 cents each, how many citrons can I buy for 60 cents?

4. A teacher had 54 pupils, which she divided into 6 equal classes: how many did she put in a class?

5. Madeleine had 36 flowers, which she divided equally among 3 of her schoolmates: how many did she give to each?

6. In a certain lawn are 49 trees, which are arranged in 7 rows: how many trees are in a row?

7. Leonard paid 30 cents for 5 lead-pencils: what was that apiece?

8. A family of 8 persons used 56 pounds of butter in a month: how much was that to a person?

9. At 10 cents a pound, how many pounds of maple-sugar can I buy for 90 cents?

10. If you have 60 cents, how many clusters of grapes can you buy, at 5 cents a cluster?

11. How long will it take to empty a cistern containing 54 barrels, if the faucet discharges 6 barrels an hour?

12. In a menagerie there are 10 cages, and 70 animals: how many animals do the cages average?

13. Henry went 7 times to the post-office, and took out 63 letters: how many did he get at a time?

14. At 8 cents a quart, how many quarts of cherries can you buy for 72 cents?

15. A gardener planted 108 hills of corn, putting 12 hills in a row: how many rows did he have?

16. If one man can do a piece of work in 48 days, how long will it take 8 men to do it?

ANALYSIS.—8 men can do 8 days work in 1 day; therefore, to do 48 days work, it will take them as many days as 8 is contained times in 48, and 8 is in 48, 6 times. *Ans.* 6 days.

17. If 1 barrel of flour is sufficient to last 1 person 36 weeks, how long will it last 9 persons?

18. One man was left in charge of a fort with provisions adequate to last 63 days: how long would the provisions last 7 men?

19. By reading 1 hour a day, it takes Josephine 54 days to read a volume of history: how long will it take her, if she reads 6 hours a day?

20. I have a job which one man can do in 72 days: how long will it take 6 men to do it?

E. 1. A farmer bought 6 yards of cloth, at 4 dollars a yard, and paid for it in wood, worth 3 dollars a cord: how many cords did it take to pay for the cloth?

ANALYSIS.—Since 1 yard costs 4 dollars, 6 yards must cost 6 times 4, or 24 dollars. Again, if 3 dollars will buy 1 cord of wood, 24 dollars will buy as many cords as 3 dollars are contained times in 24 dollars, which are 8 times. Therefore, it took 8 cords to pay for the cloth.

NOTE.—In this and similar examples, the general principle is, to find the *cost* of the goods, the *price* and *quantity* of which are given; then to find what *quantity* of the article taken in exchange is *equivalent* to this *amount*.

2. A grocer sold 3 pounds of tea, at 8 shillings a pound, and took his pay in butter, at 4 shillings a pound: how many pounds of butter did he receive for his tea?

3. George sold 10 pears, at 3 cents apiece, and took his pay in chestnuts, at 6 cents a quart: how many quarts of chestnuts did he receive?

4. A man sold 12 sheep, at 3 dollars a head, and took flour in exchange, at 9 dollars a barrel: how many barrels of flour did he receive?

5. In 4 times 9, how many times 12?

6. In 4 times 12, how many times 6? Times 8?

7. In 6 times 10, how many times 5? Times 12?

8. A country lad sold 6 quarts of blackberries, at 12 cents a quart, and was paid in oranges, at 6 cents apiece: how many oranges did he receive?

9. Edward exchanged 12 apples, at 2 cents each, for bananas, at 3 cents each: how many bananas did he receive?

10. When cheese is 10 cents a pound, how many pounds will it take to pay for 20 quarts of cranberries, at 5 cents a quart?

11. In 8 times 6, how many times 4? Times 6?

12. In 9 times 8, how many times 12? Times 6?

F. 1. John bought 12 pears at 3 cents apiece, and sold them at 5 cents apiece: how much did he make on his pears?

ANALYSIS.—Since he bought at 3 cents, and sold at 5 cents, he made 2 cents on each pear. As he made 2 cents on 1 pear, on 12 pears he made 12 times 2, or 24 cents.

2. A baker bought 8 barrels of flour, at 6 dollars a barrel, and sold the same, at 9 dollars a barrel: how much did he make?

3. If a grocer buys eggs, at 10 cents a dozen, and sells them, at 16 cents a dozen, how much will he make on 12 dozen ?

4. What is the difference between 9 times 6, and 7 times 9 ?

5. What is the difference between 12 times 5, and 6 times 12 ?

6. A woman bought strawberries, at 6 cents a quart, and sold them at 10 cents: if she sells 10 quarts in the morning and 8 in the afternoon, how much will she receive for her day's work ?

7. If a merchant buys silk, at 9 shillings a yard, and sells it, at 7 shillings, how much will he lose on 12 yards ?

8. What is the difference between 7 times 9, and 9 times 8 ?

9. A newsboy gives 3 cents apiece for his papers, and sells them, at 4 cents: how much does he make on 100 papers ?

10. A man bought 12 acres of land, at 15 dollars an acre, and sold it, at 11 dollars: how much did he lose by the operation ?

11. A merchant bought 9 sable skins, at 12 dollars apiece, and sold them, at 20 dollars: how much did he make on them ?

12. If I buy buffalo robes, at 4 dollars apiece, and sell them, at 10 dollars, how much shall I make on 10 robes ?

13. If you buy chestnuts, at 6 cents a quart, and sell them, at 11 cents a quart, how much will you make on 12 quarts ?

G. 1. William having 33 cents, wishes to lay it out in writing-books, which are 6 cents each: how many writing-books can he buy, and how many cents will he have over?

ANALYSIS.—Since 6 cents will buy 1 writing-book, 33 cents will buy as many as 6 cents are contained times in 33 cents. Now 6 cents are contained in 33 cents, 5 times, and 3 over. Therefore, he can buy 5 writing-books, and have 3 cents over.

2. How many eggs, at 3 cents each, can be bought for 20 cents, and what remainder?

3. How many live chickens, at 4 shillings each, can be bought for 32 shillings, and what remainder?

4. How many times 7 in 45? 7 in 52?

5. How many times 6 in 53? 6 in 57?

6. In 58 how many times 9? 9 in 75?

7. In 65 how many times 10? 10 in 97?

8. If knives are 4 shillings apiece, how many can be bought for 42 shillings?

9. How many mirrors, at 9 dollars apiece, can be bought for 75 dollars?

10. How many yards of silk, at 4 dollars a yard, can a lady buy for a 50 dollar bill, and how much change will she have left?

11. George bought a sled for 68 cents, and gave 5 quarts of chestnuts, at 10 cents a quart: how much did he owe for it?

12. If I buy a watch for 75 dollars, and pay 10 barrels of flour, at 7 dollars a barrel, how much shall I owe for the watch?

13. How many muffs, at 9 dollars each, can be had for 85 dollars?

NOTATION.

1. What is a single thing called?

Ans. A *unit* or *one*.

2. What are one and one more called? "Two."

3. Two and one more? "Three."

4. Three and one more? "Four."

5. What are the terms, one, two, three, four, etc.?

Ans. The *Names of numbers*, and are often taken for *numbers* themselves.

6. What is number?

Ans. *Number* is a unit, or a collection of units.

ARABIC NOTATION.

7. How are numbers commonly expressed?

Ans. By *figures* and *letters*.

8. What is the method of expressing numbers by *figures* called?

Ans. The *Arabic Notation*.

9. How many figures does the Arabic Notation employ?

Ans. The following *ten*, viz.:

1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

One, two, three, four, five, six, seven, eight, nine, naught.

10. What is the greatest number that can be expressed by *one* figure?

Ans. *Nine*.

11. How is *ten* expressed? (p. 11.)

12. What is the greatest number that can be expressed by *two* figures?

Ans. Ninety-nine.

13. How is a *hundred* expressed? (p. 15.)

14. What is the greatest number that can be expressed by *three* figures.

Ans. Nine hundred and ninety-nine.

15. How is a *thousand* expressed? (p. 16.)

Write the following numbers in figures:

1. One hundred and one.
2. One hundred and seven.
3. One hundred and ten.
4. One hundred and twelve.
5. One hundred and twenty.
6. Four hundred and fifty.
7. Five hundred and ninety-nine.
8. Two thousand and ten.
9. Three thousand two hundred and one.
10. Four thousand three hundred and twenty.
11. Five thousand two hundred and three.
12. Six thousand six hundred and ten.
13. Eight thousand and five hundred.
14. Nine thousand nine hundred and ninety-nine.

ROMAN NOTATION.

1. What is the method of expressing numbers by *letters* called?

Ans. The Roman Notation.

2. What letters does it employ?

Ans. The following seven: I, V, X, L, C, D, M.

3. What do the letters in the following Table denote?

I	denotes one.	XXX	denotes thirty.
II	" two.	XL	" forty.
III	" three.	L	" fifty.
IV	" four.	LX	" sixty.
V	" five.	LXX	" seventy.
VI	" six.	LXXX	" eighty.
VII	" seven.	XC	" ninety.
VIII	" eight.	C	" one hundred.
IX	" nine.	CC	" two hundred.
X	" ten.	CCC	" three hundred.
XI	" eleven.	CCCC	" four hundred.
XII	" twelve.	D	" five hundred.
XIII	" thirteen.	DC	" six hundred.
XIV	" fourteen.	DCC	" seven hundred.
XV	" fifteen.	DCCC	" nine hundred.
XVI	" sixteen.	M	" one thousand.
XVII	" seventeen.	MD	" one thousand and
XVIII	" eighteen.		five hundred.
XIX	" nineteen.	MDC	" one thousand and
XX	" twenty.		six hundred.

MDCCLXXVI, eighteen hundred and seventy-six.

Express the following numbers by letters:

1. Four. Six. Eight. Nine. Eleven. Twelve.
2. Fourteen. Eighteen. Sixteen. Thirteen. Nineteen.
3. Twenty. Twenty-one. Twenty-two. Twenty-nine.
4. Forty. Forty-four. Fifty-six. Sixty-nine. Eighty.
5. One hundred. Ninety. One hundred and ten.
6. Five hundred. Five hundred and twenty.
7. Six hundred and ten. One thousand and ten.
8. Fifteen hundred. Sixteen hundred and five.
9. One thousand eight hundred and seventy-two.

NUMERATION.

1. What is the method of reading numbers expressed by figures called?

Ans. Numeration.

2. Recite the Numeration Table, beginning at the right.

TABLE.

9	4	5,	8	0	7,	7	4	5,	4	7	2.
Hundreds of Billions.	Tens of Billions.	Billions.	Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.
} Period IV.			} Period III.			} Period II.			} Period I.		
Billions.			Millions.			Thousands.			Units.		

3. What orders occupy the first three places?

4. The second three? The third? The fourth?

5. How many figures in a period?

6. What is the first period on the right called?
The second? The third? The fourth?

Copy and read the following, naming the orders.

7. 102.	13. 1001.	19. 6010.
8. 330.	14. 1205.	20. 7254.
9. 640.	15. 2064.	21. 9045.
10. 809.	16. 3605.	22. 10410.
11. 918.	17. 4068.	23. 260125.
12. 974.	18. 5304.	24. 5231256.

FRACTIONS.

LESSON I.

TO TEACHERS.—The object of this and the next two Lessons is to develop the *idea* of *Fractions*, and the *meaning* of the *terms* by which they are expressed. It is advisable to have a variety of objects at hand, as apples, pears, paper, etc., which can easily be separated in two, three, or more equal parts, and, as far as practicable, let the pupils separate these objects into different fractional parts for themselves.

1. If you cut an apple into *two* equal parts, what is one of the parts called?

Ans. One half.

2. If you put these parts together again, to what will they be equal?

Ans. A whole apple.

3. How many halves make a whole one?

Ans. Two.

4. If you break a pencil into *three* equal parts, what are the parts called?

Ans. Thirds.

5. If you put these three parts together again, to what will they be equal?

Ans. A whole pencil.

6. How many thirds make a whole one?

Ans. Three.

7. If you divide a sheet of paper into *four* equal parts, what are the parts called?

Ans. Fourths, or quarters.

8. How many fourths make a whole one?

Ans. Four.

9. If a thing is divided into *five* equal parts, what are the parts called?

Ans. Fifths.

10. How many fifths make a whole one?

11. If a thing is divided into *six* equal parts, what are the parts called?

12. If divided into *seven* equal parts, what?

13. If into *eight* equal parts, what? If into *nine*, what? If into *ten*, what?

14. What is meant by a half? (See Q. 1.)

Ans. One of the two equal parts into which a number or thing is divided. (P. 89, Q. 1.)

15. What is meant by a third? Two thirds?

16. What is meant by a fourth? Three-fourths?

17. What is meant by a fifth? Two fifths? Four fifths?

18. What is meant by a sixth? Two sixths? Five eighths? Four ninths? Nine tenths?

LESSON II.

1. A gentleman distributed 3 dollars equally among some beggars, giving a half dollar to each: how many beggars were there?

ANALYSIS.—There were as many beggars as there are halves in 3 dollars. Now as there are 2 halves in 1 dollar, in 3 dollars there must be 3 times 2, or 6 halves. Therefore, there were 6 beggars.

2. If I cut a melon into halves, how many halves shall I have? *Ans. Two.*

3. Why?

Ans. Because two halves make a whole one.

4. If I cut 2 melons in halves, how many halves shall I have?

5. How many halves in 5 apples?

6. A lady divided two loaves of bread among a company of hungry boys, giving a third of a loaf to each: how many boys were there in the company?

7. How many thirds are there in 4? In 5?

8. Reduce 3 dollars to fourths of a dollar?

9. Reduce 4 to fifths? Reduce 7 to sixths?

10. In 5 and 3 fourths dollars, how many fourths are there?

ANALYSIS.—Since in 1 dollar there are 4 fourths, in 5 dollars there must be 5 times 4 fourths, or 20 fourths, and 3 fourths make 23 fourths. Therefore, etc.

11. In 3 and 1 half apples, how many halves?

12. In 4 and 2 thirds yards, how many thirds of a yard?

13. In 8 and 3 fifths pounds of candy, how many fifths of a pound?

14. In 5 and 1 sixth, how many sixths?

15. In 7 and 3 eighths, how many eighths?

16. In 9 and 7 tenths, how many tenths?

LESSON III.

1. How many apples in 4 halves?

ANALYSIS.—Since in 2 halves there is 1 whole one, in 4 halves there are as many whole apples as 2 is contained times in 4; and 2 is in 4, 2 times. Therefore, in 4 halves there are 2 apples.

2. How many whole ones in 6 halves? In 8 halves? In 10 halves? In 12 halves?

3. How many dollars in 7 half dollars?

Ans. Three and 1 half dollars.

4. 9 is how many times 2?

Ans. 4 times 2 and half of 2.

5. 11 is how many times 2? 13? 15? 17?

6. How many apples in 5 thirds of an apple?

Ans. One and 2 thirds of an apple.

7. How many whole ones in 6 thirds? In 9 thirds?
In 12 thirds? In 15 thirds?

8. 7 is how many times 3?

Ans. 2 times and 1 third of 3.

9. 8 is how many times 3? 10? 11? 13? 17?

10. How many whole ones in 7 thirds? In 8 thirds?
In 20 thirds? In 29 thirds?

11. Mary had 8 quarters of a dollar, which she exchanged for whole dollars: how many did she receive?

12. Reduce 12 fourths to whole ones.

13. Reduce 16 fourths to whole ones.

14. 13 is how many times 4? 15? 17? 19? 21?

15. How many whole ones in 10 fifths? In 15
fifths?

16. How many whole ones in 25 fifths?

17. 17 is how many times 5? 21? 33? 42?

18. Reduce 29 fifths to whole ones?

19. How many pounds of honey in 13 fourths of a
pound?

ANALYSIS.—Since in 4 fourths there is 1 pound, in 13 fourths there are as many pounds as 4 is contained times in 13, which are 3 times and 1 fourth over. Therefore, in 13 fourths there are 3 and 1 fourth pounds.

20. How many dollars in 25 half-dollars?

21. How many yards in 17 thirds of a yard?
 22. How many bushels in 11 fourths of a bushel?
 23. A gentleman bought 17 lots of land, each containing $\frac{1}{5}$ of an acre, and fenced it into fields of $\frac{1}{5}$ acre each: how many fields did he make?
 24. A man having $\frac{43}{100}$ bushels of corn, wishes to know how many poor people he can supply with a bushel apiece, and how much he will have over?
-

LESSON IV.

TO TEACHERS.—The object of the following Lessons is to familiarize the class with simple calculations involving fractions. *Operations in fractions*, when the terms applied to them are fully understood, are essentially as easy as those in whole numbers.

1. George bought 2 peaches for $\frac{1}{2}$ cent each: how much did he pay for both?

ANALYSIS.—Since 1 peach costs $\frac{1}{2}$ cent, 2 peaches will cost 2 times $\frac{1}{2}$ cent; and 2 times $\frac{1}{2}$ are 2 halves, or 1 cent. Therefore, he paid 1 cent for both.

2. At $\frac{1}{2}$ dollar a bushel, what will 4 bushels of apples cost?

3. What cost 6 melons, at $\frac{1}{3}$ of a dollar apiece?

4. What cost 8 chestnuts, at $\frac{1}{4}$ of a cent apiece?

5. What will 4 apples cost, at $\frac{2}{3}$ of a cent apiece?

ANALYSIS.—If 1 apple costs $\frac{2}{3}$ of a cent, 4 apples will cost 4 times $\frac{2}{3}$ cent, which are $\frac{8}{3}$ thirds, equal to 2 and $\frac{2}{3}$ thirds cents. Therefore, etc.

6. What cost 5 pounds of butter, at $\frac{1}{4}$ of a dollar a pound?

7. Charles bought 6 plums, at $\frac{3}{4}$ of a cent each: what did he pay for them?

8. What will 7 bushels of apples cost, at $\frac{3}{4}$ of a dollar a bushel?

9. How much is 5 times $\frac{2}{5}$ of a dollar?

10. How much is 4 times $\frac{2}{3}$ of a yard?

11. What is 6 times $\frac{4}{10}$?

12. What is 8 times $\frac{5}{9}$?

13. At $\frac{5}{8}$ of a dollar a pound, what will be the cost of 6 pounds of tea?

14. Bought 6 oranges, at $\frac{4}{10}$ of a dime apiece: what did they come to?

15. What will 7 grammars cost, at $\frac{9}{10}$ of a dollar apiece?

LESSON V.

1. If 1 lemon costs 2 cents, what will $\frac{1}{2}$ of a lemon cost?

ANALYSIS.—If a whole lemon costs 2 cents, $\frac{1}{2}$ of a lemon must cost $\frac{1}{2}$ of 2 cents; and half of 2 cents is 1 cent. Therefore, $\frac{1}{2}$ of a lemon will cost 1 cent.

2. At $\frac{1}{2}$ cent each, what will 4 apples cost?

3. What is $\frac{1}{2}$ of 6 cents?

Ans. 3 cents.

4. Why?

Ans. If you divide 6 cents into two equal parts, the parts will be halves, and each part will contain 3 cents.

5. What is $\frac{1}{2}$ of 8 dimes? Of 10 dimes? 14 dimes? 20 dimes?

6. What is $\frac{1}{3}$ of 6 apples?

7. What is $\frac{1}{3}$ of 9 marbles?

8. If a melon costs 12 cents, what will $\frac{1}{3}$ of a melon cost?

9. What is $\frac{1}{3}$ of 15? Of 21? Of 18? Of 27?

10. What is $\frac{1}{4}$ of 8 dollars?

Ans. 2 dollars.

11. Why?

Ans. Because, if 8 dollars are divided into 4 equal parts, the parts will be fourths, and each part will contain 2 dollars.

12. What is $\frac{1}{4}$ of 4 pounds? Of 12 pounds? Of 20? Of 28? Of 36?

13. What is $\frac{1}{5}$ of 5 yards? Of 15? Of 20? Of 25? Of 30? Of 40?

14. If a barrel of flour costs 12 dollars, what will $\frac{1}{6}$ of a barrel cost?

15. If a ton of hay is worth 15 dollars, what is $\frac{1}{5}$ of a ton worth?

16. If land is worth 21 dollars an acre, what will $\frac{1}{7}$ of an acre cost? If 28 dollars, what?

17. When corn is 40 cents a bushel, what will be the cost of $\frac{1}{8}$ of a bushel?

18. At 60 dollars a ton, what is the expense of $\frac{1}{12}$ of a ton?

19. What is $\frac{1}{9}$ of 18? Of 36? Of 27? Of 54? Of 63?

20. What is $\frac{1}{10}$ of 20? Of 30? Of 80? Of 100? Of 60?

LESSON VI.

1. What will 2 thirds of a ton of coal cost, at 6 dollars a ton?

ANALYSIS.—Since 3 thirds, or a *whole* ton, costs 6 dollars, 1 third of a ton will cost 1 third of 6, which is 2 dollars. Again, since 1 third of a ton costs 2 dollars, 2 thirds will cost 2 times 2, or 4 dollars. Therefore, 2 thirds of a ton will cost 4 dollars.

2. If a tub of butter costs 12 dollars, what will 2 thirds of a tub cost?

3. If the price of a watermelon is 16 cents, what is the price of 3 fourths of it?

4. What is 2 fourths of 12? 3 fourths of 12? 4 fourths of 12?

5. What cost 3 fifths of a drum of figs, at 15 shillings per drum?

6. What must I pay for 5 sevenths of a ton of hay, when hay is worth 21 dollars a ton?

7. What will 3 fourths of a yard of silk come to, at 12 shillings a yard?

8. What is 4 fifths of 25? Of 30? Of 45? Of 50? Of 60?

9. What is 5 sixths of 18? Of 24? Of 30? Of 42? Of 48?

10. What is 3 sevenths of 35? 5 sevenths of the same? 4 sevenths? 6 sevenths?

11. What will 5 eighths of an acre of land cost me, at 24 dollars per acre? What will 3 eighths cost? 7 eighths?

12. What is 2 ninths of 18? Of 27? Of 36?

13. What is $\frac{4}{9}$ of 45? $\frac{5}{9}$ of the same?
 $\frac{7}{9}$ of 45? $\frac{8}{9}$ of 45? $\frac{9}{9}$ of 45?

14. If George can earn 35 cents in 1 day, how much can he earn in $\frac{3}{7}$ of a day?

15. What will $\frac{5}{10}$ of a ton of iron cost, at 40 dollars a ton? What will $\frac{7}{10}$ of a ton cost?

16. What is $\frac{7}{10}$ of 20? Of 30? Of 40? Of 50?

LESSON VII.

1. What part of 2 marbles is 1 marble?

ANALYSIS.—If 2 marbles are divided into 2 equal parts, each part will contain 1 marble. Therefore, 1 marble is $\frac{1}{2}$ of 2 marbles.

2. What part of 3 is 1?

Ans. 1 is $\frac{1}{3}$ of 3, or $\frac{1}{3}$ of 3.

3. What part of 3 is 2?

Ans. 2 is 2 times $\frac{1}{3}$ of 3, or $\frac{2}{3}$ of 3.

4. In 1 yard there are 3 feet: what part of a yard is 1 foot? What part is 2 feet?

5. 1 is what part of 4?

Ans. 1 is $\frac{1}{4}$ of 4.

6. 3 is what part of 4?

Ans. 3 is 3 times $\frac{1}{4}$ of 4, or $\frac{3}{4}$ of 4.

7. What part of 5 is 2? What part is 3? Is 4? Is 5? Is 7?

8. What part of 6 is 4? Of 7 is 3? Of 9 is 5? Of 10 is 7? Of 12 is 11?

9. What part of 3 cents is 4 cents?

ANALYSIS.—1 cent is $\frac{1}{3}$ third part of 3 cents. Therefore, 4 cents are 4 times $\frac{1}{3}$ third, or $\frac{4}{3}$ thirds of 3 cents.

10. What part of 4 farthings is 2 farthings? Is 3 farthings? Is 4 farthings? Is 7 farthings? Is 9 farthings?

11. What part of 5 chestnuts is 2 chestnuts? What part of 5 is 3? Is 4? Is 6? Is 10? Is 12? Is 15?

12. In 1 dime there are 10 cents: what part of a dime will a pear cost, the price of which is 3 cents?

13. At 5 cents, what part of a dime is the cost of an orange?

14. What part of 12 inches is 1 inch? Is 3 in.? Is 7 in.? Is 12 in.? Is 15 in.? Is 30 in.?

15. What part of 16 ounces is 4 oz.? Is 12 oz.? Is 20 oz.?

16. What part of 20 shillings is 2 s.? Is 4 s.? Is 5 s.? Is 10 s.?

LESSON VIII.

1. Henry, on his way to school, lost 2 apples, which was a third of all he had: how many apples had he?

ANALYSIS.—Since 2 is $\frac{1}{3}$ third of his apples, 3 thirds, or the whole number, must be 3 times 2 apples; and 3 times 2 are 6 apples. Therefore, he had 6 apples.

2. 3 is a half of what number?

Ans. 3 is a half of 2 times 3; and 2 times 3 are 6.

3. 4 is a third part of what number?

4. Henrietta paid 2 cents for a thimble, which was a fourth of all the money she had: how many cents had she?

5. 3 is a fourth of what number?

6. 5 is a sixth of what number?

7. 4 is $\frac{2}{3}$ of what number?

ANALYSIS.—Since 4 is $\frac{2}{3}$ of a certain number, 1 third of that number is $\frac{1}{2}$ of 4, which is 2; and 3 thirds are 3 times 2, or 6. Therefore, 4 is $\frac{2}{3}$ of 6.

8. 6 is $\frac{2}{3}$ of what number?

9. On his way to school, Henry gave a beggar 8 cents, which was half his money: how many cents had he?

10. 9 is $\frac{3}{4}$ of what number?

11. William paid 10 cents for a melon, which was $\frac{2}{5}$ of all the money he had: how much had he?

12. A laboring man paid 20 cents for a peck of meal, which was $\frac{5}{10}$ of all he had earned that day: how much had he earned?

13. 12 is $\frac{6}{7}$ of what number?

14. 16 is $\frac{2}{8}$ of what number?

15. The price of a slate is 15 cents, which is $\frac{3}{4}$ of the price of a spelling-book: what is the cost of a spelling-book?

16. 21 is $\frac{3}{7}$ of what number?

17. 25 is $\frac{5}{7}$ of what number?

18. George paid 18 cents for a writing-book, which was $\frac{2}{3}$ the price of his arithmetic: what was the price of his arithmetic?

LESSON IX.

1. If pears are 2 cents apiece, what part of a pear can you buy for 1 cent?

ANALYSIS.—1 cent is 1 half of 2 cents; therefore, for 1 cent you can buy 1 half of 1 pear.

2. When oranges are 4 cents apiece, what part of an orange can you buy for 3 cents?

3. At 6 shillings a yard, what part of a yard of gingham can you buy for 2 s.? For 3 s.?

4. If a man can saw a cord of wood in 5 hours, what part of a cord can he saw in 3 hours?

5. At 8 cents a quart, what part of a quart of cherries can you buy for 4 cents? For 6 cts.? For 8 cts.?

6. If melons are 10 cents each, what part of a melon can I buy for 2 cents? What part for 5 cents?

7. What part of a week is 2 days? 3 days? 5 days? 6 days? 8 days? 20 days?

8. At 12 cents apiece, what part of a pineapple can you buy for 4 cents? For 6 cts.? For 8 cts.? For 3 cts.? For 7 cts.? For 9 cts.?

9. What part of a dime is 2 cents? 3 cts.? 8 cts.? 10 cts.? 15 cts.? 30 cts.? 50 cts.?

10. What part of 3 shillings is 2 s.? 3 s.? 4 s.?

11. If land is 20 dollars an acre, what part of an acre can I buy for 4 dollars? For 5 dols.? For 10 dols.? For 15 dols.?

12. At 25 dollars a ton, what part of a ton of hay can I buy for 5 dols.? For 10 dols.? For 13 dols.? For 17 dols.? For 20 dols.?

LESSON X.

1. How much braid, at 4 cents a yard, can I buy for 5 cents?

ANALYSIS.—Since 4 cents will buy 1 yard, 1 cent will buy 1 fourth of a yard, and 5 cents will buy 5 times 1 fourth, or 5 fourths of a yard, which are equal to 1 and 1 fourth yards. Therefore, 5 cents will buy 1 and 1 fourth yards.

2. At 5 cents apiece, how many bananas can be purchased with 6 cents?

3. At 6 cents an ounce, how much candy can George buy for 7 cents? For 8 cents? For 10 cents?

4. At 8 cents a pound, how much sal-soda can be bought for 12 cents? For 16 cents? For 20 cts.?

5. When flour is 9 dollars a barrel, how many barrels can be had for 12 dollars?

6. At 10 cts. a pound, how much maple sugar can be bought for 23 cents? For 25 cts.? For 34 cts.? For 45 cents.

7. How many melons, at 12 cts. each, will 25 cts. buy? 30 cts.? 36 cts.? 50 cts.?

8. How much soda, at 14 cents a pound, can be bought for 21 cents? For 28 cents?

9. At 15 cents a pound, how many raisins can be bought for 20 cts.? For 30 cts.? For 35 cts.?

10. When coffee is 25 cents a pound, how much can be bought for 30 cts.? For 40 cts.? For 50 cts.?

11. How much land, at 20 dollars per acre, can be bought for 25 dollars? For 30 dola.? For 40 dola.?

12. At 30 cts. a pound, how much honey can be bought for 40 cents? For 60 cents?

LESSON XI.

1. What will 4 lemons cost, at 2 and 1 half cents each ?

ANALYSIS.—Since 1 lemon costs 2 and 1 half cents, 4 will cost 4 times as much. Now 4 times 2 cents are 8 cents, and 4 times 1 half are 4 halves, which are equal to 2 cents; and 2 cents added to 8 cents make 10 cents. Therefore, etc.

2. What will be the expense of 5 pencils, at 3 and 1 half cents apiece ?

3. What will 6 pounds of tea cost, at 6 and 1 half dimes a pound ?

4. What will 8 oranges come to, at 6 and 1 fourth cents a piece ?

5. At 12 and 1 half cents a yard, what will 10 yards of muslin cost ?

6. At 5 and 1 third cts. each, what will 6 oranges come to ?

7. What will 7 slates cost, at 9 and 1 eighth of a cent apiece ?

8. At 6 and 1 half dollars a ton, what will 5 tons of coal come to ?

9. At 7 and 1 half cents each, what will 6 tops cost ?

10. What is 4 times 4 and 3 fourths ?

11. What is the cost of making 10 coats, at 6 and 3 fourths dollars apiece ?

12. What is 8 times 6 and 5 eighths ?

13. What is 9 times 7 and 4 fifths ?

14. What is 10 times 8 and 5 sevenths ?

15. What will be the cost of 5 cords of wood, at 3 and 3 fourths dollars a cord ?

LESSON XII.

1. If 1 half an apple costs 1 cent, how much will a whole apple cost?

ANALYSIS.—If 1 half an apple costs 1 cent, 2 halves, or a whole apple will cost 2 times 1 cent, which are 2 cents.

2. If 1 half an ounce of candy costs 3 cents, what will a whole ounce cost?

3. If half a yard of tape costs 4 cents, what will a yard cost?

4. If a third of a melon costs 3 cents, what will 2 thirds cost?

5. One fourth of a pound of soda is worth 5 cents: what are 2 fourths worth? 3 fourths? 4 fourths? A whole pound?

6. Sarah paid 4 cents for 1 fifth of a yard of ribbon: how much must she have paid for 3 fifths of a yard?

7. If 1 eighth of a ton of hay is worth 2 dollars, what are 3 eighths worth? 5 eighths? 7 eighths? 8 eighths?

8. A man paid 3 dollars for 1 tenth of an acre of land: what would 5 tenths of an acre cost? 7 tenths? A whole acre?

9. If 1 fourth of a yard of silk is worth 1 half dollar, how much are 2 fourths worth? 3 fourths? 4 fourths? 6 fourths?

10. If 1 fifth of a box of honey is worth 1 fourth of a dollar, what are 3 fifths of a box worth?

11. If 1 tenth of a barrel of flour is worth 5 eighths of a dollar, how much are 3 tenths of a barrel worth? 8 tenths? A whole barrel?

LESSON XIII.

TO TEACHERS.—This Lesson develops the process of repeating a number a certain number of times, and a *part* of another time.

1. What will 3 yards and 1 half yard of tape cost, at 2 cents a yard?

ANALYSIS.—Since 1 yard cost 2 cents, 3 and 1 half yards will cost 3 and 1 half times 2 cents. Now 3 times 2 cents are 6 cents, and 1 half of 2 cents is 1 cent, which, added to 6 cents, makes 7 cents.

2. How many are 3 times 4, and 1 half of 4?

3. At 3 dollars a barrel, what will 4 barrels and 1 third of a barrel of apples cost?

4. How many are 4 times 6, and 1 third of 6?

5. At 4 dollars a yard, how much will 3 yards and 1 fourth of a yard of cloth come to?

6. 3 times 8, and 1 fourth of 8, are how many?

7. If a lad earns 5 dollars a month, how much will he earn in 4 and 1 fifth months?

8. 4 times 10, and 1 fifth of 10, are how many?

9. At 3 cents apiece, what will 4 pears and 2 thirds of a pear cost?

ANALYSIS.—Since 1 pear costs 3 cents, 4 and 2 thirds pears will cost 4 and 2 thirds times 3 cents. Now 4 times 3 cents are 12 cents, and 2 thirds of 3 cents are 2 cents, which, added to 12, make 14 cents. Therefore, etc.

10. How many are 5 times 3, and 2 thirds of 3?

11. In 1 week there are 7 days: how many days are there in 3 weeks, and 4 sevenths of a week?

12. At 8 dollars a ton, what will 5 tons, and 3 eighths of a ton, of coal come to?

LESSON XIV.

1. When a unit is divided into *equal* parts, as halves, thirds, fourths, fifths, etc., what are these parts called?

Ans. Fractions.

2. What then is a fraction?

Ans. A Fraction is one or more of the *equal parts* into which a *unit* is divided.

3. How are fractions commonly expressed?

Ans. By two numbers, called the *numerator* and *denominator*, written one above the other, with a short line between them.

4. How express one half, one third, two thirds, etc.?

One half	is expressed by	$\frac{1}{2}$
One third	"	$\frac{1}{3}$
Two thirds	"	$\frac{2}{3}$
One fourth	"	$\frac{1}{4}$
Three fourths	"	$\frac{3}{4}$
Four fifths	"	$\frac{4}{5}$
Nine tenths	"	$\frac{9}{10}$, etc.

5. Which is the denominator, and what does it show?

Ans. The denominator is the number *below* the line, and shows into *how many equal parts* the unit is divided?

6. Which is the numerator, and what does it show?

Ans. The numerator is the number *above* the line, and shows *how many parts* are expressed by the fraction.

REMARKS.—1. The numerator is so called, because it *numbers* the parts taken.

2. The denominator is so called, because it *names* the parts ; as, halves, thirds, fourths, etc.

3. A *denominator* is said to be *common*, when two or more fractions have the *same number* for their denominator.

7. When a whole number and a fraction are expressed together, what do they form ?

Ans. A *mixed* number.

8. How is $4\frac{3}{5}$ read ?

Ans. Four and three fifths.

Read the following fractions : *

9. $\frac{1}{2}$.	13. $\frac{3}{8}$.	17. $\frac{6}{10}$.	21. $4\frac{1}{2}$.
10. $\frac{2}{3}$.	14. $\frac{5}{6}$.	18. $\frac{7}{12}$.	22. $5\frac{1}{4}$.
11. $\frac{3}{4}$.	15. $\frac{1}{7}$.	19. $\frac{15}{17}$.	23. $7\frac{5}{8}$.
12. $\frac{2}{3}$.	16. $\frac{5}{8}$.	20. $\frac{17}{18}$.	24. $18\frac{3}{11}$.

25. When *two thirds* are expressed by the figures $\frac{2}{3}$, what is the figure below the line called ; and what show ?

Ans. The 3 *below* the line is called the *denominator*, and shows that the unit is divided into *three* equal parts.

26. What is the figure above the line called ; and what show ?

The 2 *above* the line is called the *numerator*, and shows that *two* parts are taken.

Explain the following in like manner :

27. $\frac{3}{4}$.	30. $\frac{4}{5}$.	33. $\frac{4}{5}$.	36. $1\frac{1}{10}$.
28. $\frac{7}{8}$.	31. $\frac{6}{10}$.	34. $\frac{5}{8}$.	37. $3\frac{1}{2}$.
29. $\frac{5}{8}$.	32. $\frac{5}{12}$.	35. $\frac{4}{7}$.	38. $10\frac{9}{10}$.

* It is recommended to intersperse the reading of fractions with writing them upon the slate or blackboard.

QUESTIONS FOR REVIEW.

4. 1. George paid $\frac{3}{4}$ of a dollar for a cap, and $\frac{1}{4}$ of a dollar for a pair of gloves: how much did he pay for both?

ANALYSIS.—3 fourths and 2 fourths are 5 fourths of a dollar, and 5 fourths are equal to 1 and $\frac{1}{4}$ dollars. Therefore, he paid $1\frac{1}{4}$ dollars for both.

REMARK.—When *two or more* fractions are parts of the *same kind* of unit, and have a *common denominator*, their *numerators are like numbers*, and may be *added, subtracted, and divided* in the same manner as whole numbers.

2. If your father gives you $\frac{3}{8}$ of a dollar, your mother $\frac{2}{8}$, and your brother $\frac{1}{8}$ of a dollar, how much will you then have?

3. A baker gave $\frac{1}{4}$ of a loaf of bread to one beggar, $\frac{2}{4}$ to another, $\frac{1}{4}$ to another: how many loaves did he give away?

4. How many dollars are $\frac{1}{8}$, $\frac{2}{8}$, $\frac{3}{8}$, and $\frac{4}{8}$ of a dollar?

5. How many are $\frac{1}{6}$, $\frac{2}{6}$, $\frac{3}{6}$, and $\frac{4}{6}$?

6. How many are $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, and $\frac{4}{5}$?

7. A man sold $1\frac{3}{4}$ tons of coal to one customer, and $2\frac{1}{4}$ tons to another: how much did he sell to both?

ANALYSIS.—1 ton and 2 tons are 3 tons; 3 fourths and 2 fourths are 5 fourths, or 1 and $\frac{1}{4}$ tons, which added to 3 tons make $4\frac{1}{4}$ tons. Therefore, he sold $4\frac{1}{4}$ tons.

8. A poor woman paid $8\frac{1}{2}$ cts. for a small measure of potatoes, and $12\frac{1}{2}$ cts. for flour: how much did she pay for both?

9. What is the sum of $4\frac{5}{8}$ dollars and $6\frac{1}{8}$ dollars?

10. What is the sum of $7\frac{3}{10}$ yards and $5\frac{2}{10}$ yards?

11. If Charles has $\frac{4}{5}$ of a melon, and gives away $\frac{3}{5}$ of it, how much will he have left?

ANALYSIS.—3 fifths taken from 4 fifths leave 1 fifth. Therefore, he had 1 fifth left. (Rem. Ex. 1.)

12. John had $\frac{3}{4}$ of a dollar, and gave $\frac{1}{4}$ for a kite: how much had he left?

13. Sarah had a sash $\frac{7}{8}$ of a yard long, and her sister cut from it $\frac{3}{8}$ of a yard: how long was it then?

14. What is the difference between $\frac{3}{4}$ of a dime and $\frac{1}{4}$ of a dime?

15. What is the difference between $\frac{1}{8}$ and $\frac{7}{8}$?

16. If William has a whole orange, and gives away $\frac{3}{4}$ of it, how much will he have left?

ANALYSIS.—A whole orange is equal to 1, and $\frac{3}{4}$ from 1 leaves $\frac{1}{4}$. Therefore, he will have $\frac{1}{4}$ left.

17. If you have a whole pie, and give away $\frac{2}{3}$ of it, how much will you have left?

18. A gentleman had a garden containing 1 acre of land, and sold $\frac{3}{4}$ of it: how much was left?

19. If you have a pound of maple sugar, and give away $\frac{7}{10}$ of it, what will you have left?

20. James having $1\frac{3}{4}$ dollars, gave $\frac{5}{8}$ of a dollar for a knife: how much money did he have left?

ANALYSIS.—In $1\frac{3}{4}$ dollars there are $\frac{1}{4}$ dollars, and $\frac{5}{8}$ from $\frac{1}{4}$ leaves $\frac{1}{8}$. Therefore, he had $\frac{1}{8}$ dollar left.

21. What is the difference between $2\frac{1}{2}$ and $\frac{6}{7}$?

22. What is the difference between $3\frac{3}{4}$ and $\frac{1}{4}$?

23. Charles' fish-line was $3\frac{3}{4}$ yards long, but by accident he lost $2\frac{1}{4}$ yards: how long was it then?

B. 1. What will 3 apples cost, at $\frac{2}{3}$ of a cent apiece?

ANALYSIS.—Since 1 apple costs $\frac{2}{3}$ of a cent, 3 apples will cost 3 times $\frac{2}{3}$ of a cent; and 3 times $\frac{2}{3}$ are $\frac{6}{3}$, which are equal to 2 cents. Therefore, 3 apples will cost 2 cents.

2. Nine thirds of a cent are equal to how many whole cents?

3. What cost 5 plums, at $\frac{3}{4}$ of a cent apiece?

4. What cost 7 bushels of apples, at $\frac{1}{4}$ of a dollar a bushel?

5. At $\frac{7}{8}$ of a dollar a pound, what must I pay for 5 pounds of tea?

6. At $\frac{2}{3}$ of a cent apiece, what will 12 chestnuts come to?

7. If $\frac{3}{4}$ of a yard of velvet make 1 vest, how much will be required to make 8 vests?

8. What cost 6 bushels of oats, at $\frac{6}{10}$ of a dollar a bushel?

9. If 1 house-lot contains $\frac{1}{2}$ of an acre, how much will 25 lots contain?

10. What is 9 times $\frac{5}{7}$ of a dollar?

C. 1. If 1 ounce of candy costs 6 cents, what will $\frac{1}{2}$ an ounce cost?

ANALYSIS.—If a whole ounce of candy costs 6 cents, $\frac{1}{2}$ an ounce must cost $\frac{1}{2}$ of 6 cents, which is 3 cents.

2. What is $\frac{1}{2}$ of 8 cents? Why? (P. 98, Q. 4.)

3. What is $\frac{1}{3}$ of 6 apples? $\frac{1}{3}$ of 12? $\frac{1}{3}$ of 15? $\frac{1}{3}$ of 21?

4. If 1 pound of raisins costs 20 cents, what will $\frac{1}{4}$ of a pound come to?

5. If 1 yard of edging costs 6 shillings, what will $\frac{2}{3}$ of a yard cost?

ANALYSIS.—If a whole yard costs 6 shillings, $\frac{2}{3}$ of a yard must cost $\frac{2}{3}$ of 6 shillings, which are 4 shillings. Therefore, $\frac{2}{3}$ of a yard will cost 4 shillings.

6. If 1 pound of starch costs 12 cents, what will $\frac{3}{4}$ of a pound cost?

7. If 1 pound of dates costs 15 cents, what will $\frac{3}{4}$ of a pound cost?

8. What will $\frac{5}{8}$ of a ton of iron cost, at 40 dollars a ton?

9. What will $\frac{6}{10}$ of a barrel of flour cost, at 10 dollars a barrel?

10. What will $\frac{5}{8}$ of a barrel of cranberries come to, at 16 dollars a barrel?

D. 1. If a pear costs $2\frac{1}{2}$ cents, how much will 2 pears cost?

ANALYSIS.—If 1 pear costs $2\frac{1}{2}$ cents, 2 pears will cost 2 times $2\frac{1}{2}$ cents. Now 2 times 2 cents are 4 cents, and 2 times 1 half are 2 halves, or 1 cent, which, added to 4 cents, makes 5 cents. Therefore, 2 pears will cost 5 cents.

2. How much is 3 times $1\frac{1}{2}$ dollars?

Ans. $4\frac{1}{2}$ dollars.

3. If a barrel of apples costs $2\frac{1}{2}$ dollars, what will 3 barrels cost?

4. If a yard of silk costs $2\frac{3}{4}$ dollars, what will 4 yards cost?

5. What is 4 times $3\frac{3}{4}$ yards?

6. If a cord of wood costs $3\frac{1}{4}$ dollars, what will 5 cords cost?

7. If you give 6 beggars $2\frac{1}{4}$ dollars apiece, how much will you give them all?

8. If a family consumes $3\frac{1}{2}$ bushels of potatoes in a month, how many will they consume in 4 months?

9. At $6\frac{1}{4}$ cents apiece, what will 12 oranges come to?

10. What cost 7 barrels of flour, at $8\frac{1}{2}$ dollars a barrel?

11. What will $\frac{3}{4}$ of a pound of coffee come to, at 33 cents a pound?

ANALYSIS.—If 1 pound costs 33 cents, 1 fifth of a pound will cost 1 fifth of 33 cents, or 6 and 3 fifths cents; and 4 fifths of a pound will cost 4 times 6 $\frac{3}{5}$ cents. Now, 4 times 6 are 24, and 4 times 3 fifths are 12 fifths, equal to 2 and 2 fifths, which, added to 24, make 26 and 2 fifths. Therefore, $\frac{1}{5}$ pound will cost 26 $\frac{2}{5}$ cents.

12. What will $\frac{3}{4}$ yard of ribbon cost, at 21 cts. a yard?

13. If a watermelon is worth 23 cents, what is $\frac{2}{3}$ of it worth?

14. At 38 cents a pound, what is $\frac{3}{8}$ of a pound of butter worth?

15. What will $\frac{7}{8}$ of a bushel of apples come to, at 42 cents a bushel?

16. What will $\frac{3}{4}$ of a barrel of flour come to, at 13 dollars a barrel?

E. 1. If a man walks 4 miles an hour, how far can he walk in $6\frac{3}{4}$ hours?

ANALYSIS.—In $6\frac{3}{4}$ hours he can walk $6\frac{3}{4}$ times as far as in 1 hour. Now 6 times 4 are 24 miles, and 3 fourths of 4 miles are 3 miles, which, added to 24, make 27 miles. Therefore, etc.

2. At 3 dollars a barrel, what will $8\frac{2}{3}$ barrels of cider come to?

3. If a man pays 5 dollars a week for board, what must he pay for $6\frac{2}{3}$ weeks?
4. In 1 dime there are 10 cents: how many cents in $7\frac{5}{10}$ dimes?
5. If the stage-fare is 6 cents a mile, what must a passenger pay for riding $5\frac{2}{3}$ miles.
6. At 8 dollars a barrel, what must be paid for $7\frac{3}{8}$ barrels of flour?
7. How many are $7\frac{2}{3}$ times 9?
8. How many are $9\frac{5}{8}$ times 8?
9. At 11 cents a yard, what must I pay for $6\frac{4}{11}$ yards of silk braid?
10. At 12 dollars a ton, what will a farmer receive for $6\frac{5}{12}$ tons of hay?

F. 1. At $\frac{1}{4}$ of a dollar a bushel, how many apples can I buy with $\frac{3}{4}$ of a dollar?

ANALYSIS.—Since $\frac{1}{4}$ of a dollar will buy 1 bushel, $\frac{3}{4}$ fourths of a dollar will buy as many bushels as 1 fourth is contained times in 3 fourths; and 1 fourth is contained in 3 fourths 3 times. Therefore, I can buy 3 bushels.

REMARK.—When two fractions have a *common denominator*, their numerators, we have seen, are *like numbers*; consequently, one numerator can be divided by the other, as well as whole numbers. (Rem., p. III.)

2. At $\frac{3}{4}$ of a dollar a pound, how many pounds of tea can be bought with $\frac{5}{8}$ of a dollar?
3. If calico is $\frac{1}{8}$ of a dollar a yard, how much can you buy with $\frac{7}{8}$ of a dollar?
4. Charles has 20 quarter dollars: how many melons can he buy, at $\frac{1}{4}$ of a dollar each?

5. How many times are $\frac{2}{3}$ contained in $\frac{1}{3}$?
6. How many times are $\frac{1}{2}$ contained in $\frac{1}{2}$?
7. How many times are $\frac{1}{3}$ contained in $\frac{2}{3}$?
8. At $\frac{3}{4}$ of a dollar a gallon, how many gallons of molasses can be purchased for $\frac{3}{4}$ of a dollar?
9. How much coffee, at $\frac{5}{12}$ of a dollar a pound, can be had for $\frac{5}{12}$ of a dollar?
10. How many times are $\frac{7}{11}$ contained in $\frac{7}{11}$?

G. 1. At $\frac{1}{4}$ of a dollar apiece, how many books can Harry buy for 5 dollars?

ANALYSIS.—It is plain he can buy as many books as there are *fourths* in 5 dollars. In 1 dollar there are 4 fourths, and in 5 dollars, 5 times 4, or 20 fourths. Therefore, he can buy 20 books.

2. When apples are $\frac{1}{2}$ cent each, how many can be had for 12 cents?

3. At $\frac{1}{4}$ of a dollar apiece, how many slates can be purchased for 7 dollars?

4. At $\frac{1}{3}$ of a dollar apiece, how many citrons can you buy for 4 dollars?

5. At $\frac{1}{3}$ of a cent apiece, how many cherries can you buy for 6 cents?

6. How much muslin, at $\frac{1}{6}$ of a dollar a yard, can you buy for 5 dollars?

7. How many yards of silk, at $\frac{1}{9}$ of a dollar a yard, can Harriet buy for 9 dollars?

ANALYSIS.—At $\frac{1}{9}$ of a dollar a yard, she can buy as many yards as there are *fourths* in 9 dollars. In 1 dollar there are 4 fourths, and in 9 dollars 9 times 4, which are 36 fourths.

But, it takes 3 fourths of a dollar to buy 1 yard; hence, 36 fourths will buy as many yards as 3 fourths are contained times in 36 fourths, which are 12. *Ans.* 12 yards.

8. At $\frac{2}{3}$ of a dollar apiece, how many young rabbits can William buy for 4 dollars?

9. How many pair of gloves can be bought for 3 dollars, at $\frac{6}{8}$ of a dollar a pair?

10. How much maple sugar, at $\frac{2}{10}$ of a dollar a pound, can be bought for 5 dollars?

11. How much delaine, at $\frac{4}{12}$ of a dollar a yard, can be had for 3 dollars?

12. At $\frac{4}{5}$ of a dollar a pound, how many pounds of cinnamon can be had for 8 dollars?

H. 1. Harry sold his slate for 6 cents, which was $\frac{1}{3}$ of what it cost him: what did he pay for his slate?

ANALYSIS.—The question is this: 6 is a third of what number? If 6 is 1 third, 3 thirds are 3 times 6, or 18.

Or, thus: 6 is a third of 3 times 6, which are 18.

2. William sold his old spelling-book for 5 cents, which was $\frac{1}{4}$ of what it cost him: what was the price of a new one?

3. If $\frac{1}{4}$ of a yard of ribbon costs 9 cents, what will a yard cost?

4. 7 is $\frac{1}{7}$ of what number?

5. 8 is $\frac{1}{5}$ of what number?

6. 9 is $\frac{1}{7}$ of what number?

7. George solved 12 examples, which was $\frac{3}{4}$ as many as Henry solved: how many did Henry solve?

ANALYSIS.—Since 12 is $\frac{3}{4}$ of a certain number, $\frac{1}{4}$ of that number is $\frac{1}{4}$ of 12, or 6. Again, as 6 is $\frac{1}{4}$ of a number, 3 thirds, or the whole number, must be 3 times 6, or 18. Therefore, etc.

8. If you pay 6 dollars for $\frac{2}{3}$ of a barrel of flour, what is that per barrel?

9. Paid 12 dollars for $\frac{3}{4}$ of a ton of hay: what was that per ton?

10. 24 is $\frac{3}{8}$ of what number?

11. 42 is $\frac{6}{7}$ of what number?

12. If $\frac{7}{8}$ of an acre of land costs 63 dollars, what will an acre cost?

13. 54 is $\frac{6}{8}$ of what number?

14. 72 is $\frac{8}{9}$ of what number?

I. 1. George bought 3 pears, at 6 cents apiece, what did they come to? He paid for them in peaches, at 2 cents apiece: how many peaches did it take?

ANALYSIS.—The question is this: 3 times 6 are how many times 2? 3 times 6 are 18, and 2 is in 18, 9 times. Therefore, it took 9 peaches.

2. Bought 3 yards of cloth, at 4 dollars a yard, and paid for it in apples at 2 dollars a barrel: how many barrels did it take?

3. 5 times 4 are how many times 10?

4. 6 times 4 are how many times 12?

5. Willie bought 3 inkstands, at 8 cents each, and paid for them in pears, at 4 cents each: how many pears did it take?

6. In 5 times 6, how many times 10?

7. In 4 times 12, how many times 8?

8. How much wood, worth 3 dollars a cord, must be given for 12 yards of silk, worth 2 dollars a yard?

9. Bought 4 barrels and $\frac{3}{4}$ of a barrel of cider, at 3 dollars a barrel, and paid for it in caps, at 2 dollars apiece: how many caps did it take?

10. 4 times 5, and 2 fifths of 5, are how many times 11?

11. 7 times 6, and 5 sixths of 6, are how many times 9?

12. 4 times 9, and 4 ninths of nine, are how many times 10?

13. How many chestnuts, at 8 cents a quart, will it take to pay for 5 and 6 tenths quarts of molasses, at 10 cents a quart?

K. 1. If 3 oranges cost 12 cents, what will 2 cost?

ANALYSIS.—2 oranges are $\frac{2}{3}$ of 3 oranges; therefore, 2 oranges will cost $\frac{2}{3}$ of 12 cents, and 2 thirds of 12 cents are 8 cents.

Or, thus: if 3 oranges cost 12 cents, 1 orange will cost $\frac{1}{3}$ of 12 cents, which is 4 cents. Again, if 1 orange costs 4 cents, 2 oranges will cost 2 times 4, or 8 cents.

2. If 4 apples cost 8 cents, what will 3 apples cost?

3. If 6 yards of tape are worth 18 cents, what are 5 yards worth?

4. If a man can walk 20 miles in 5 hours, how far can he walk in 4 hours?

5. What part of 8 is 5?

6. What is $\frac{3}{8}$ of 40?

7. What part of 5 is 7?

8. What is $\frac{2}{3}$ of 45?

9. If 3 barrels of flour cost 21 dollars, what will 5 barrels cost?

10. If 6 pears cost 24 cents, what will 10 cost?

11. If 7 yards of cloth cost 35 dollars, what will 8 yards cost?

12. If 5 men can do a piece of work in 6 days, how long will it take 1 man to do it?

ANALYSIS.—5 men can do 5 times as much work as 1 man; therefore, it will take 1 man 5 times as long as 5 men; and 5 times 6 are 30 days.

13. If a pound of tea will last 6 persons 12 days, how long will it last 1 person?

L. 1. If you are charged 6 cents for $\frac{1}{2}$ of a pie, what would you be charged for 6 pies?

ANALYSIS.—If $\frac{1}{2}$ of a pie costs 6 cents, 2 halves, or a whole pie, would cost 2 times 6, or 12 cents; and 6 pies would cost 6 times 12, or 72 cents.

2. If $\frac{1}{4}$ of a barrel of flour costs 3 dollars, what will 5 barrels cost?

3. If $\frac{3}{4}$ of a yard of cloth is worth 6 dollars, what are 6 yards worth.

4. Paid 6 shillings for $\frac{3}{4}$ of a pound of tea: what must I pay for 7 pounds at the same rate?

5. The price of $\frac{1}{8}$ of an acre of land is 20 dollars: what is the price of 10 acres, at the same rate?

6. If 6 yards of silk braid cost 48 cents, what will $\frac{1}{4}$ of a yard cost?

ANALYSIS.—1 yard will cost $\frac{1}{6}$ of 48 cents, which is 8 cents; and $\frac{1}{4}$ of 8 cents is 2 cents. Therefore, etc.

7. If 10 barrels of salt cost 30 dollars, what will $\frac{3}{5}$ of a barrel cost?

8. If 9 yards of cloth cost 36 dollars, what will $\frac{3}{4}$ of a yard cost?

9. If $\frac{1}{4}$ of a barrel of cranberries costs 3 dollars, what will $\frac{1}{2}$ of a barrel cost?

10. If $\frac{1}{3}$ of an acre of land yields 8 bushels of wheat, how much will $\frac{3}{4}$ of an acre yield?

11. If $\frac{1}{6}$ of a pound of nutmegs costs 12 cents, what will $\frac{5}{6}$ of a pound cost?

COMPOUND NUMBERS.

1. What are simple numbers ?

Ans. Simple Numbers are those which contain units of *one denomination* only; as, two, three, 4 oranges, 5 feet, etc.

2. What are compound numbers ?

Ans. Compound Numbers are those which contain *two* or *more* denominations of the same nature; as, 5 gals. 3 quarts and 1 pint.

NOTE.—Compound Numbers are often called Denominate Numbers.

3. What are like numbers ?

Ans. Like Numbers are those which express units of the *same kind*; as, 2 pounds and 3 pounds, four and six, etc.

4. What kind of a number is 4 pounds; and why ?

Ans. It is a *simple* number; because it contains only *one* denomination.

5. What kind of a number is 2 feet and 6 inches ?

Ans. It is a *compound* number.

6. Why ?

Ans. Because it contains *two* denominations of the same nature.

7. What kind of a number is six ? Ten ? 7 books ?

8. What are 4 pounds and 3 ounces ? 5 dollars ?

9. What do you call 2 pounds 7 shillings and 6 pence ? Why ? 10 pounds ? Why ? 5 dollars ?

UNITED STATES MONEY.

1. What is United States money?

Ans. United States Money is the national currency of the United States, and is often called *Federal Money*.

2. What are the denominations?

Ans. Eagles, dollars, dimes, cents, and mills.

TABLE.

10 mills (<i>m.</i>)	are	1 cent,	<i>ct.</i>
10 cents	"	1 dime,	<i>d.</i>
10 d. or 100 cts.	"	1 dollar,	<i>dol.</i> , or <i>¢</i> .
10 dollars	"	1 eagle,	<i>E.</i>

50 cts. = $\frac{1}{2}$ dol. ; $33\frac{1}{3}$ cts. = $\frac{1}{3}$ dol. ; 25 cts. = $\frac{1}{4}$ dol. ;

20 cts. = $\frac{1}{5}$ dol. ; $12\frac{1}{2}$ cts. = $\frac{1}{8}$ dol. ; 10 cts. = $\frac{1}{10}$ dol.

3. How many kinds of coins have the United States?

Ans. Four: gold, silver, nickel, and bronze.

REMARKS.—1. The *gold* coins are the *double-eagle*, the *eagle*, *half-eagle*, *quarter eagle*, the *dollar*, and *three-dollar pieces*.

2. The *silver* coins are the *dollar*, *half-dollar*, *quarter-dollar*, *dime*, *half-dime*, and *three-cent pieces*.

3. The *nickel* coins are the *five-cent*, and *three-cent pieces*.

4. The *bronze* coins are the *cent*, and *two-cent pieces*.

4. In 5 dimes, how many cents?

ANALYSIS.—Since there are 10 cents in one dime, there must be 10 times as many cents as dimes ; and 10 times 5 are 50 cents. Therefore, in 5 dimes there are 50 cents.

5. How many cents in 4 dimes? In 6 dimes?

6. How many cents in 7 dimes? In 9 dimes?

7. How many cents in 7 dols.? In 8 dols.?

9. In 23 cents, how many dimes?

ANALYSIS.—Since in 10 cents there is 1 dime, in 23 cents there are as many dimes as 10 cents are contained times in 23 cents; and 10 is in 23, 2 times, and 3 cents over. Therefore, etc.

10. How many dimes in 30 cents? In 45 cents? In 60 cents? In 75 cents? In 86 cents? In 100 cents?

11. How many dollars in 100 cents? In 120 cents?

12. How many dollars in 200 cents? In 300 cents? In 450 cents? In 600 cents? In 800 cents? In 1000 cents.

ENGLISH MONEY.

1. What is English money?

Ans. English Money is the national currency of Great Britain, and is often called *Sterling Money*.

2. What are the denominations?

Ans. Pounds, shillings, pence, and farthings.

TABLE.

4 farthings (<i>gr.</i> or <i>far.</i>)	are 1 penny,	<i>d.</i>
12 pence	" 1 shilling,	<i>s.</i>
20 shillings	" 1 pound, or sovereign,	<i>£.</i>
21 shillings	" 1 guinea,	<i>g.</i>

NOTE.—The legal value of a *pound sterling*, or *sovereign*, is \$4.84; the value of an English *shilling* is 24½ cents; and that of a *penny*, about 2 cents.

3. How many farthings in 3 pence?

ANALYSIS.—Since there are 4 farthings in one penny, there must be 4 times as many far. as pence; and 4 times 3 are 12 far.

4. How many farthings in 4 pence? In 5 pence?
5. How many farthings in 8 pence? In 10 pence?
6. How many farthings in 6 pence and 2 farthings?

Ans. In 6 pence there are 4 times 6, or 24 far., and 2 are 26 far.

7. How many farthings in 8 pence and 3 farthings?
8. How many pence in 2 shillings?
9. How many pence in 4 s.? In 3 s.? In 6 s.?
10. How many pence in 4 s. and 6 d.? In 5 s.
11. How many shillings in £2 and 4 s.? In £3?
12. In 11 farthings how many pence?

ANALYSIS.—Since in 4 far. there is 1 penny, in 11 far. there are as many pence as 4 far. are contained times in 11 far.; and 4 far. are in 11 far. 2 times and 3 over. Therefore, etc.

13. How many pence in 12 far.? In 24 far.?
14. How many shillings in 24 d.? In 30 d.?
15. How many pounds in 40 s.? In 50 s.? In 60 s.?

TROY WEIGHT.

1. For what is Troy weight used?

Ans. For weighing *gold, silver, and jewels.*

2. What are the denominations?

Ans. Pounds, ounces, pennyweights, and grains.

TABLE.

24 grains (<i>gr.</i>)	are	1 pennyweight,	<i>pwt.</i>
20 pennyweights	"	1 ounce,	<i>oz.</i>
12 ounces	"	1 pound,	<i>lb.</i>

NOTE.—The best method of imparting to children a correct idea of *Weights* and *Measures*, is to let them *see* and *handle* the *standards in use*, or some *material objects* which are equal to the several *units of length, surface, capacity, and weight*. A plain set of the more important ones can be obtained at a trifling expense, and every primary school should have them.

The Compound Tables present a wide field for “Object Teaching;” and, with the above facilities, cannot fail to impart much valuable information, and *quicken the perceptive faculties* of the learner.

3. How many grains in 2 pennyweights?
 4. How many pennyweights in 3 ounces?
 5. How many ounces in 3 pounds? In 4 pounds?
 - In 5 pounds? In 7 pounds?
 6. In 48 grains, how many pennyweights?
 7. In 40 pennyweights, how many ounces? In 42 pwt.? In 60 pwt.? In 68 pwt.?
 8. In 24 ounces, how many pounds? In 39 ounces?
-

AVOIRDUPOIS WEIGHT.

1. For what is Avoirdupois Weight used?

Ans. For weighing all *coarse articles*; as, hay, cotton, meat, groceries, etc., and all metals except *gold* and *silver*.

2. What are the denominations?

Ans. Tons, hundreds, pounds, and ounces.

TABLE.

16 ounces (oz.)	are 1 pound,	lb.
100 pounds	“ 1 hundred weight,	cwt.
20 cwt., or 2000 lbs.,	“ 1 ton,	T.
8 oz. are $\frac{1}{2}$ lb.;	4 oz. are $\frac{1}{4}$ lb.	

NOTES.—1. The *ounce* is often divided into *halves*, *quarters*, etc.

2. The *dram*, as a unit of Avoirdupois Weight, and the *quarter* of 25 or 28 pounds, are not used in business transactions.

3. How many ounces in 2 pounds? In 3 pounds?
4. How many ounces in 2 pounds and 4 ounces?
5. In 20 ounces, how many pounds?
6. In 32 ounces, how many pounds? In 40 ounces?
7. In 40 hundred weight, how many tons?
8. How many hundreds in 3 tons?
9. In half a pound, how many ounces?
10. In a fourth of a pound, how many ounces?

APOTHECARIES' WEIGHT.

1. For what is Apothecaries' Weight used?

Ans. For *mixing medicines*.

2. What are the denominations?

Ans. Pounds, ounces, drams, scruples, and grains.

TABLE.

20 grains (<i>gr.</i>)	are	1 scruple, <i>sc.</i> , or $\mathfrak{D}$.
3 scruples	"	1 dram, <i>dr.</i> , or 3.
8 drams	"	1 ounce, <i>oz.</i> , or $\frac{3}{4}$.
12 ounces	"	1 pound, <i>lb.</i>

NOTES.—1. The only difference between *Troy* and *Apothecaries'* weight, is in the *division* of the *ounce*. The *pound*, *ounce*, and *grain* are the same in each.

2. As this Table is strictly *professional*, it may be omitted by beginners at the discretion of the teacher.

LINEAR MEASURE.

1. For what is Linear Measure used?

Ans. For measuring that which has *length*, without *breadth*; as, lines, distances, etc. It is often called *Long Measure*.

2. What are the denominations?

Ans. Leagues, miles, furlongs, rods, yards, feet, and inches.

TABLE.

12 inches (<i>in.</i>)	are 1 foot,	<i>ft.</i>
3 feet	" 1 yard,	<i>yd.</i>
16½ feet, or 5½ yards	" 1 rod, perch, or pole, <i>r.</i> , or <i>p.</i>	
40 rods,	" 1 furlong,	<i>fur.</i>
8 fur., or 320 rods	" 1 mile	<i>m.</i>
3 miles	" 1 league,	<i>l.</i>

NOTE.—The inch is commonly divided into *halves*, *fourths*, *eighths*, or *tenths*; sometimes into *twelfths*, called *lines*.

3. Draw a straight line 1 inch long upon the black-board; the others make one on their slates.

4. Make one 2 in. long. 3 in. long. 4 in. long. 6 in. long. A foot long.

5. How long is your Arithmetic? How wide? How long is your slate? How wide?

6. How long is this table? How wide?

NOTE.—This exercise should be *varied*, and continued at the discretion of the teacher. It will be found exceedingly useful in imparting to children correct ideas of the ordinary measures of length.

7. How many inches in 2 feet? In 4 feet?

8. How many feet in 2 yards? In 3 yards?

9. How many feet in 4 yards and 2 feet? In 5 yards and 1 foot?
10. How many yards in 9 feet? In 12 feet?
11. In 2 furlongs, how many rods?
12. In 4 leagues, how many miles? In 5 leagues?
13. How many feet in 24 in.? In 30 in.? In 36 in.?
14. How many yards in 9 feet? In 13 ft.? In 18 ft.?

CLOTH MEASURE.

1. For what is Cloth Measure used?

Ans. For measuring those articles whose *length only* is considered; as, cloths, laces, ribbons, etc.

2. What are the denominations?

Ans. Its principal unit is the *linear yard*. This is divided into halves, fourths, eighths, and sixteenths?

TABLE

3 ft. or 36 in.	are	1 yard,	<i>yd.</i>
18 in.,	"	1 half yard,	$\frac{1}{2}$ <i>yd.</i>
9 in.,	"	1 quarter yard,	$\frac{1}{4}$ <i>yd.</i>
$4\frac{1}{2}$ in.,	"	1 eighth "	$\frac{1}{8}$ <i>yd.</i>
$2\frac{1}{4}$ in.,	"	1 sixteenth "	$\frac{1}{16}$ <i>yd.</i>

NOTE.—*Ells* Flemish, English, and French, are no longer used in the United States; and the *naïl*, as a measure, is practically obsolete.

3. How many yards in 8 half yards? In 17? In 24?
4. How many yards in 16 fourths? In 28 fourths?
5. How many yards in 17 eighths? In 34 sixteenths?

SQUARE MEASURE.

1. For what is Square Measure used?

Ans. For measuring *surfaces*; as, land, flooring, etc. It is often called *Land Measure*.

2. What are the denominations?

Ans. Acres, square rods, square yards, square feet, and square inches.

TABLE.

144 square in. (<i>sq. in.</i>)	are	1 square foot, <i>sq. ft.</i>
9 square feet	"	1 square yard, <i>sq. yd.</i>
30 $\frac{1}{4}$ square yards, or }	"	{ 1 square rod, perch, or pole, <i>sq. r.</i>
272 $\frac{1}{4}$ square feet	"	
160 square rods	"	1 acre, <i>A.</i>
640 acres	"	1 square mile, <i>sq. m.</i>

REMARKS.—1. A *square* is a rectangular figure which has *four* equal sides, and *four right angles*.

2. A *square inch* is a square, each side of which is *one* inch in length.

3. A *square yard* is a square, each side of which is *one* yard in length.

NOTES.—1. The *corners* of any square figure, also of a book, a table, a room, etc., are *right angles*.

2. The acre was formerly divided into 4 roods; but, in practice, the rood is no longer used as a unit of measure.

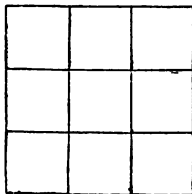
3. Make a right angle upon the blackboard.

4. Make a square inch.

5. Make a square whose side is 3 inches. 6 inches.

6. Make a square foot. A square yard.

9 sq. ft. = 1 sq. yard.



7. Divide a square yard into square feet.
8. Divide a square foot into square inches.
9. How many square feet in 5 square yards?
10. How many square yards in 36 square feet?
11. How many square inches in 2 square feet?

CUBIC MEASURE.

1. For what is Cubic Measure used?

Ans. For measuring *solids*; as, timber, boxes of goods, the capacity of rooms, ships, etc. It is often called *Solid Measure*.

2. What are the denominations?

Ans. Cords, tons, cubic yards, cubic feet, and cubic inches.

TABLE.

1728 cubic inches (<i>cu. in.</i>)	are	1 cubic foot, <i>cu. ft.</i>
27 cubic feet	"	1 cubic yard, <i>cu. yd.</i>
128 cubic feet	"	1 cord, <i>C.</i>

What is a cube?

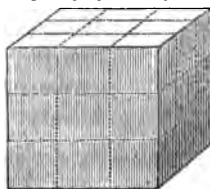
A **cube** is a regular solid bounded by *six equal squares*, called its *faces*.

A **cubic inch** is a cube, each side of which is a square inch.

A **cubic yard** is a cube, each side of which is a square yard.

A **Cord** of wood is a pile 8 ft. long, 4 ft. wide, and 4 ft. high; for, $8 \times 4 \times 4 = 128$.

$3\text{ft.} \times 3 \times 3 = 1 \text{ cu. yd.}$



A *Cord Foot* is one foot in length of such a pile; hence, 8 cord feet make 1 cord.

NOTES.—1. Timber is now measured by cubic feet and inches.

2. The *old cubic ton* of 40 feet of round timber, or 50 feet of hewn timber, has fallen into disuse.

3. Draw a cubic inch.
4. Draw a cube whose sides are 2 inches square.
5. Draw a cubic foot.
6. How many inches long and wide must a block be to form a cubic foot?
7. How many feet high is a cubic yard?
8. How many cubic feet in 2 cubic yards?
9. How many cubic feet in 2 tons of shipping?
10. How many cubic feet in 2 cords of wood?

DRY MEASURE.

1. For what is Dry Measure used?

Ans. For measuring *grain, fruit, salt, etc.*

2. What are the denominations?

Ans. Chaldrons, bushels, pecks, quarts, and pints.

TABLE.

2 pints (<i>pt.</i>)	are	1 quart,	<i>qt.</i>
8 quarts	"	1 peck,	<i>pk.</i>
4 pecks, or 32 qts.,	"	1 bushel,	<i>bu.</i>
36 bushels	"	1 chaldron,	<i>ch.</i>

NOTE.—The *dry* quart is equal to $1\frac{1}{2}$ liquid quart nearly.

3. In 6 pints, how many quarts? In 12 pints?
4. In 12 quarts, how many pecks? In 16 quarts?

5. In 20 quarts, how many pecks? In 24 quarts?
6. How many pecks in 2 bushels? In 6 bushels?
7. How many quarts in 3 pecks? In 7 pecks?
8. How many quarts in 5 pecks and 3 quarts?
9. In 5 pecks, how many bushels? In 8 pecks?
10. How many bushels in 12 pecks? In 15 pecks?
11. How many quarts in 2 bushels?
12. How many quarts in 1 bushel and 1 peck?
13. How many pints in 3 pecks?
14. How many bushels in 2 chaldrons?

LIQUID MEASURE.

1. For what is Liquid Measure used?

Ans. For measuring *milk, wine, vinegar, molasses*, etc.

2. What are the denominations?

Ans. Hogsheads, barrels, gallons, quarts, pints, and gills.

TABLE.

4 gills (<i>gi.</i>)	are 1 pint,	<i>pt.</i>
2 pints	" 1 quart,	<i>qt.</i>
4 quarts	" 1 gallon,	<i>gal.</i>
31½ gallons	" 1 barrel,	<i>bar.</i> , or <i>bbl.</i>
63 gallons, or 2 bbls.,	" 1 hogshead,	<i>hhd.</i>

NOTES.—1. Liquid Measure is often called *Wine Measure*.

2. *Beer Measure* is practically obsolete in this country.

3. How many gills in 2 pints? In 6 pints?
4. How many pints in 3 quarts? In 8 quarts?

5. How many quarts in 3 gallons? In 4 gallons?
6. How many quarts in 5 gallons and 2 quarts?
7. In 16 quarts, how many gallons?
8. In 22 quarts, how many gallons?
9. In 8 pints, how many quarts? In 12 pints?
10. How many quarts in 13 pints? In 20 pints?
11. In 15 gills, how many pints? In 20 gills?
12. How many quarts in 6 gallons and 3 quarts?
13. How many pints in 7 quarts and 1 pint?
14. How many gills in 10 pints and 3 gills?

CIRCULAR MEASURE.

1. For what is Circular Measure used?

Ans. For measuring *angles, latitude and longitude*, the *motion* of the heavenly bodies, etc.

2. What are the denominations?

Ans. Signs, degrees, minutes, and seconds.

TABLE.

60 seconds (")	are	1 minute,	'
60 minutes	"	1 degree,	°
30 degrees	"	1 sign,	s
360 degrees	are	1 circumference,	c or cir.

NOTE.—Signs, as a measure, are used only in astronomy.

3. What is a circle?

Ans. A **Circle** is a plane figure bounded by a curve line, every part of which is *equally distant* from a point within called the *center*.

4. What is the *circumference* of a circle?

Ans. The **Circumference** of a circle is the curve line by which it is bounded.

5. What is the diameter?

Ans. The **Diameter** is a straight line drawn through the *centre*, terminating at each end in the *circumference*.

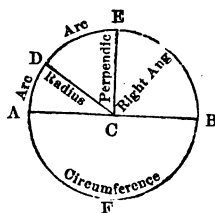
6. What is the radius?

Ans. The **Radius** is a straight line drawn from the *center* to the *circumference*, and is equal to *half* the diameter.

7. What is an arc of a circle?

Ans. An **Arc of a circle** is any part of the *circumference*.

In the adjoining figure, A D E B F is the circumference; A B, the diameter; C A, C D, C E, etc., are radii; A D, D E, are arcs.



8. What is a degree? A minute? A second?

Ans. A **Degree** is one 360th part of the *circumference* of a circle. It is divided into 60 equal parts, called *minutes*; the *minute* is divided into 60 *seconds*.

9. Draw a circle. Draw a diameter. Draw another diameter perpendicular to the first.

10. How many angles do these two diameters form, and what called?

Ans. **Four Angles**, called **right angles**.

11. How many degrees in a right angle?

Ans. **Ninety**.

TIME.

1. What are the denominations of time?

Ans. Centuries, years, months, weeks, days, hours, minutes, and seconds.

TABLE.

60 seconds (<i>sec.</i>)	are 1 minute,	<i>min.</i>
60 minutes	" 1 hour,	<i>h.</i>
24 hours	" 1 day,	<i>d.</i>
7 days	" 1 week,	<i>w.</i>
365 days, or } 52 w. and 1 d., }	" 1 common year,	<i>c. y.</i>
366 days	" 1 leap year,	<i>l. y.</i>
12 calendar months (<i>mo.</i>)	" 1 civil year,	<i>y.</i>
100 years	" 1 century,	<i>cen.</i>

NOTE.—In most business transactions, 30 days are considered a month. Four weeks are sometimes called a *lunar month*.

2. What is a common year?

Ans. A **common year** is one which contains 365 days.

3. What is a solar year?

Ans. A **solar year** is the time in which the earth revolves around the sun, and is equal to 365 d., 5 h., 48 min., and 49.7 sec.

NOTE.—The *excess* of the *solar* above the *common* year is about 6 hours, or $\frac{1}{4}$ of a day; hence, in 4 years, it amounts to 1 day, nearly.

4. What is a leap year?

Ans. A **leap year** is one which contains 366 days.

5. How is the leap year caused ?

Ans. It is caused by the *excess* of a *solar* above a *common* year.

6. Why so called ?

Ans. It is so called, because it leaps over the limit, or runs on one day more than the common year.

7. To which month is it given ?

Ans. This day is given to February, because it is the shortest month ; hence, in leap years, February has 29 days.

8. What is a civil year ?

Ans. A *civil year* is the year adopted by government for computing time, and includes both *common* and *leap* years as they occur.

9. Into how many months is it divided ?

Ans. Into *twelve calendar* months.

10. Name the calendar months.

January	(<i>Jan.</i>),	the first month,	has 31 days.
February	(<i>Feb.</i>),	" second	" 28 "
March	(<i>Mar.</i>),	" third	" 31 "
April	(<i>Apr.</i>),	" fourth	" 30 "
May	(<i>May</i>),	" fifth	" 31 "
June	(<i>June</i>),	" sixth	" 30 "
July	(<i>July</i>),	" seventh	" 31 "
August	(<i>Aug.</i>),	" eighth	" 31 "
September	(<i>Sept.</i>),	" ninth	" 30 "
October	(<i>Oct.</i>),	" tenth	" 31 "
November	(<i>Nov.</i>),	" eleventh	" 30 "
December	(<i>Dec.</i>),	" twelfth	" 31 "

NOTE.—The following lines will aid the learner in remembering the months which have 30 days each :

“Thirty days hath September,
April, June, and November.”

Each of the other months have 31 days, except February, which in common years has 28 days, but in leap years, 29.

11. Into how many seasons is the year divided ?

Ans. Four, *Spring, Summer, Autumn,*
and *Winter.*

12. Name the months of each season.

Spring consists of March, April, and May.

Summer “ June, July, and August.

Autumn “ September, October, and November.

Winter “ December, January, and February.

13. From what are the days of the week named ?

They received their names from certain ancient gods or objects of worship. Thus,

Sunday is from the *Sun*, to which it was dedicated.

Monday is from the moon, to which it was sacred.

Tuesday is from *Tuisco*, the god of *war*.—Hence, Tuesday was set apart for *litigation* and *combats*.

Wednesday is from *Woden*, the highest god of northern Europe.

Thursday is from *Thor*, the god of thunder, who was supposed to preside over the mischievous spirits in the elements.

Friday is from *Friga*, the northern goddess of beauty and marriage.

Saturday is from the planet *Saturn*, to which it was dedicated.

14. From what are the names of the months derived?

They were borrowed from the Romans, and most of them had a fanciful origin. Thus,

January is from *Janus*, the god of the sun and the year, to whom this month was dedicated.

February, from the Latin *februo*, to *purify*, or *expiate*, was so called, because the great festival of purification took place on the 15th of this month.

March is from *Mars*, the Roman god of war. It was originally the *first month* of the Roman year.

April is from the Latin *aperio*, to open; and is so called because this is the month in which the earth and vegetation open for new fruit.

May is from the goddess *Maia*, to whom the first day of this month was consecrated by sacrifices.

June is from the goddess *Juno*, to whom this month was sacred.

July is from *Julius Cæsar*, who was born in this month.

August is from *Augustus Cæsar*, who entered upon his first consulate in this month.

September, from the Latin *septem*, *seven*, was so called, because it was originally the *seventh* month of the Roman year. It is the *ninth* month in our year.

October, from the Latin *octo*, *eight*, was so called because it was the *eighth* month of the Roman year.

November, from the Latin *novem*, *nine*, was so called because it was the *ninth* month of the Roman year.

December, from the Latin *decem*, *ten*, was so called because it was the *tenth* month of the Roman year.

MISCELLANEOUS TABLES.

12 things are 1 dozen.	12 gross are 1 great gro.
12 doz. " 1 gross.	20 things " 1 score.
24 sheets are 1 quire of paper.	2 reams are 1 bundle.
20 quires " 1 ream.	5 bundles " 1 bale.
2 leaves are 1 folio.	
4 leaves " 1 quarto, or 4to.	
8 leaves " 1 octavo, or 8vo.	
12 leaves " 1 duodecimo, or 12 mo.	
18 leaves " 1 eighteen mo.	
24 leaves " 1 twenty-four mo.	

NOTE.—The terms *folio*, *quarto*, *octavo*, etc., denote the number of leaves into which a sheet of paper is folded in making books.

Fractional Parts of a Month.

20 days = $\frac{2}{3}$ month.	5 days = $\frac{1}{6}$ month.
15 " = $\frac{1}{2}$ "	3 " = $\frac{1}{10}$ "
10 " = $\frac{1}{3}$ "	2 " = $\frac{1}{15}$ "
6 " = $\frac{1}{5}$ "	1 " = $\frac{1}{30}$ "

Fractional Parts of a Year.

9 months = $\frac{3}{4}$ year.	3 months = $\frac{1}{4}$ year.
8 " = $\frac{2}{3}$ "	2 " = $\frac{1}{6}$ "
6 " = $\frac{1}{2}$ "	1½ " = $\frac{1}{8}$ "
4 " = $\frac{1}{3}$ "	1 " = $\frac{1}{12}$ "

QUESTIONS FOR REVIEW.

1. How many mills in 5 cents? In 8 cents?
2. How many cents in 2 dollars? In 3 dols.? In 5 dols.?
3. How many dollars in 200 cents? In 350 cents?
4. How many cents in $\frac{1}{2}$ dollar? In $\frac{1}{4}$ dollar?
5. How many pence in 24 farthings? In 36 far.?
6. In 6 pence, how many farthings? In 8 pence?
7. In 18 pence, how many shillings? In 30 pence?
8. In £2 how many shillings? In £4? In £5?
9. How many shillings in £ $\frac{1}{2}$? In £ $\frac{1}{4}$? In £ $\frac{1}{8}$?
10. How many inches in 2 feet? In 3 ft.? In 4 ft.?
11. How many feet in 3 yards? In 5 yards? In 7 yards?
12. How many feet in 27 inches? In 40 in.? In 63 in.?
13. In 10 feet, how many yards? In 15 ft.? In 30 ft.?
14. In 32 ounces, how many pounds Avoirdupois? In 48 ounces? In 64 ounces?
15. How many ounces in 2 lbs. Avoirdupois? In 3 lbs.?
16. How many ounces in $\frac{1}{2}$ lb. Avoirdupois? In $\frac{1}{4}$ lb.?
17. How many ounces in 1 $\frac{1}{2}$ lbs. Avoirdupois? In 1 $\frac{1}{4}$ lbs.?
18. In 3 pints, how many gills? In 5 pints? In 8 pints?
19. In 3 quarts, how many pints? In 4 qts.? In 6 qts.?

20. In 12 quarts, how many gallons? In 16 qts.?
In 20 qts.?
21. In 8 pints, how many quarts? In 11 pints?
In 16 pints?
22. In 3 quarts and 1 pint, how many pints?
23. In 2 gallons and 2 quarts, how many quarts?
24. How many quarts in 3 pecks? In 5 pecks?
25. How many pecks in 4 bushels? In 6 bushels?
26. How many days in 3 weeks? In 4 weeks?
27. How many minutes in 2 hours? In $\frac{1}{2}$ hour?
28. What part of a bushel is 1 peck? 3 pecks?
29. What part of a gallon is 1 quart? 2 qts.? 3 qts.?
30. What part of a yard is 9 inches? 12 in.? 24 in.?
31. What part of a pound Avoirdupois is 4 ounces?
8 oz.? 12 oz.?
32. If a peck of apples costs 10 cents, what will a
bushel cost?
33. If 8 cents will buy $\frac{1}{4}$ lb. of candy, how much will
40 cents buy?
34. What will 4 yards of braid come to, at $6\frac{1}{4}$ cents
a yard?
35. How many quarts of milk can I buy for 30
cents, if I pay 5 cents a pint?
36. If 3 lbs. of butter last a family a week, how long
will 28 lbs. last them?
37. What will 8 yards of silk cost, at $2\frac{1}{2}$ dols. a yard?
38. If 1 pound of cinnamon cost 32 cents, what will
4 ounces cost? What part of 1 pound is 4 oz.? Is 8
oz.? Is 12 oz.?
39. If 1 gallon of vinegar cost 40 cents, what will 1
quart cost?

MULTIPLICATION TABLE.

2 times			3 times			4 times			5 times		
1	are	2	1	are	3	1	are	4	1	are	5
2	"	4	2	"	6	2	"	8	2	"	10
3	"	6	3	"	9	3	"	12	3	"	15
4	"	8	4	"	12	4	"	16	4	"	20
5	"	10	5	"	15	5	"	20	5	"	25
6	"	12	6	"	18	6	"	24	6	"	30
7	"	14	7	"	21	7	"	28	7	"	35
8	"	16	8	"	24	8	"	32	8	"	40
9	"	18	9	"	27	9	"	36	9	"	45
10	"	20	10	"	30	10	"	40	10	"	50
11	"	22	11	"	33	11	"	44	11	"	55
12	"	24	12	"	36	12	"	48	12	"	60
6 times			7 times			8 times			9 times		
1	are	6	1	are	7	1	are	8	1	are	9
2	"	12	2	"	14	2	"	16	2	"	18
3	"	18	3	"	21	3	"	24	3	"	27
4	"	24	4	"	28	4	"	32	4	"	36
5	"	30	5	"	35	5	"	40	5	"	45
6	"	36	6	"	42	6	"	48	6	"	54
7	"	42	7	"	49	7	"	56	7	"	63
8	"	48	8	"	56	8	"	64	8	"	72
9	"	54	9	"	63	9	"	72	9	"	81
10	"	60	10	"	70	10	"	80	10	"	90
11	"	66	11	"	77	11	"	88	11	"	99
12	"	72	12	"	84	12	"	96	12	"	108
10 times			11 times			12 times					
1	are	10	10	"	100	7	"	77	4	"	48
2	"	20	11	"	110	8	"	88	5	"	60
3	"	30	12	"	120	9	"	99	6	"	72
4	"	40	11 times			10	"	110	7	"	84
5	"	50	1	are	11	11	"	121	8	"	96
6	"	60	2	"	22	12	"	132	9	"	108
7	"	70	3	"	33	12 times			10	"	120
8	"	80	4	"	44	1	are	12	11	"	132
9	"	90	5	"	55	2	"	24	12	"	144
			6	"	66	3	"	36			

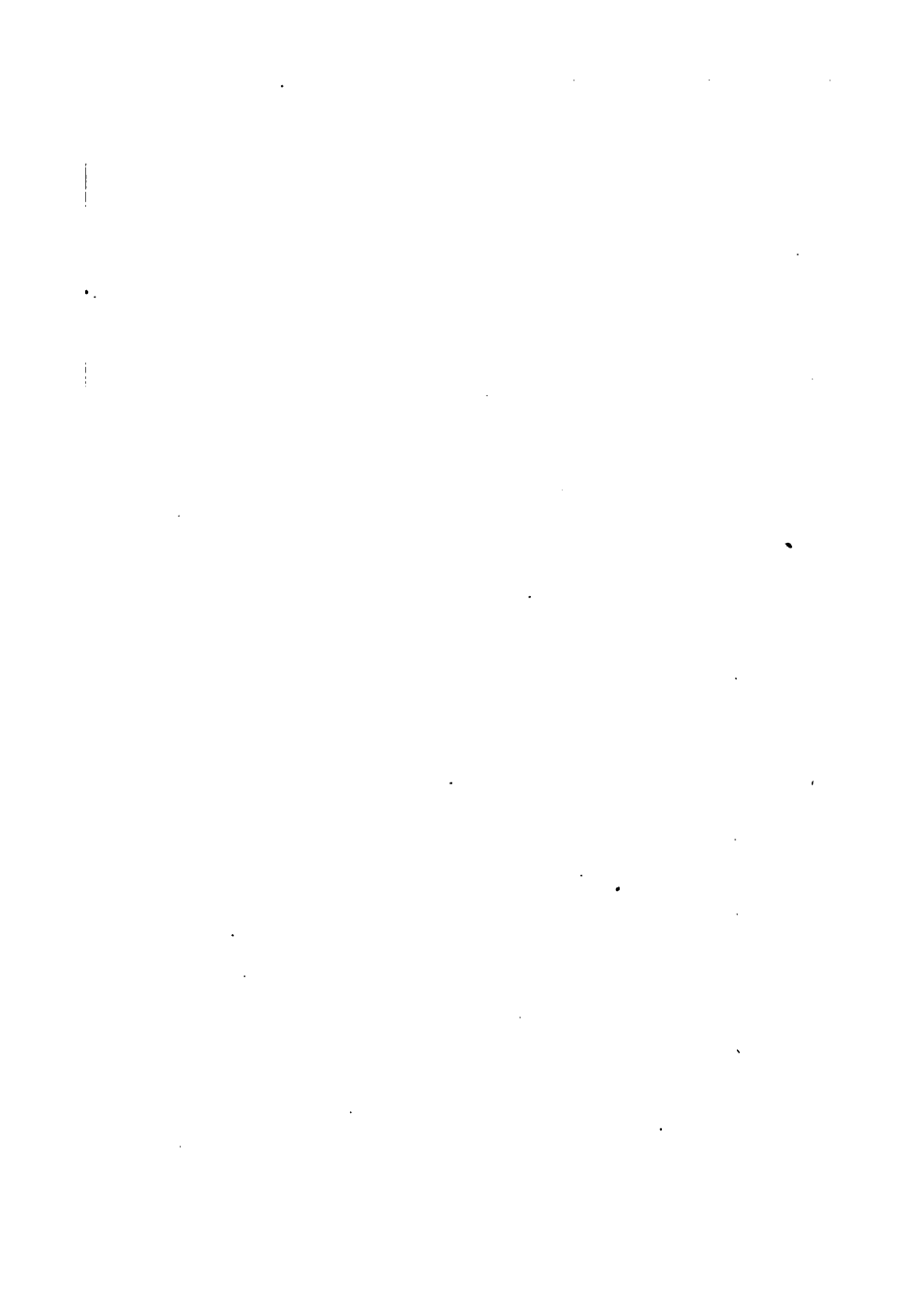
DIVISION TABLE.

1 is in 1, once.	2 is in 2, once.	3 is in 3, once.
1 " 2, 2*	2 " 4, 2*	3 " 6, 2*
1 " 3, 3	2 " 6, 3	3 " 9, 3
1 " 4, 4	2 " 8, 4	3 " 12, 4
1 " 5, 5	2 " 10, 5	3 " 15, 5
1 " 6, 6	2 " 12, 6	3 " 18, 6
1 " 7, 7	2 " 14, 7	3 " 21, 7
1 " 8, 8	2 " 16, 8	3 " 24, 8
1 " 9, 9	2 " 18, 9	3 " 27, 9
1 " 10, 10	2 " 20, 10	3 " 30, 10

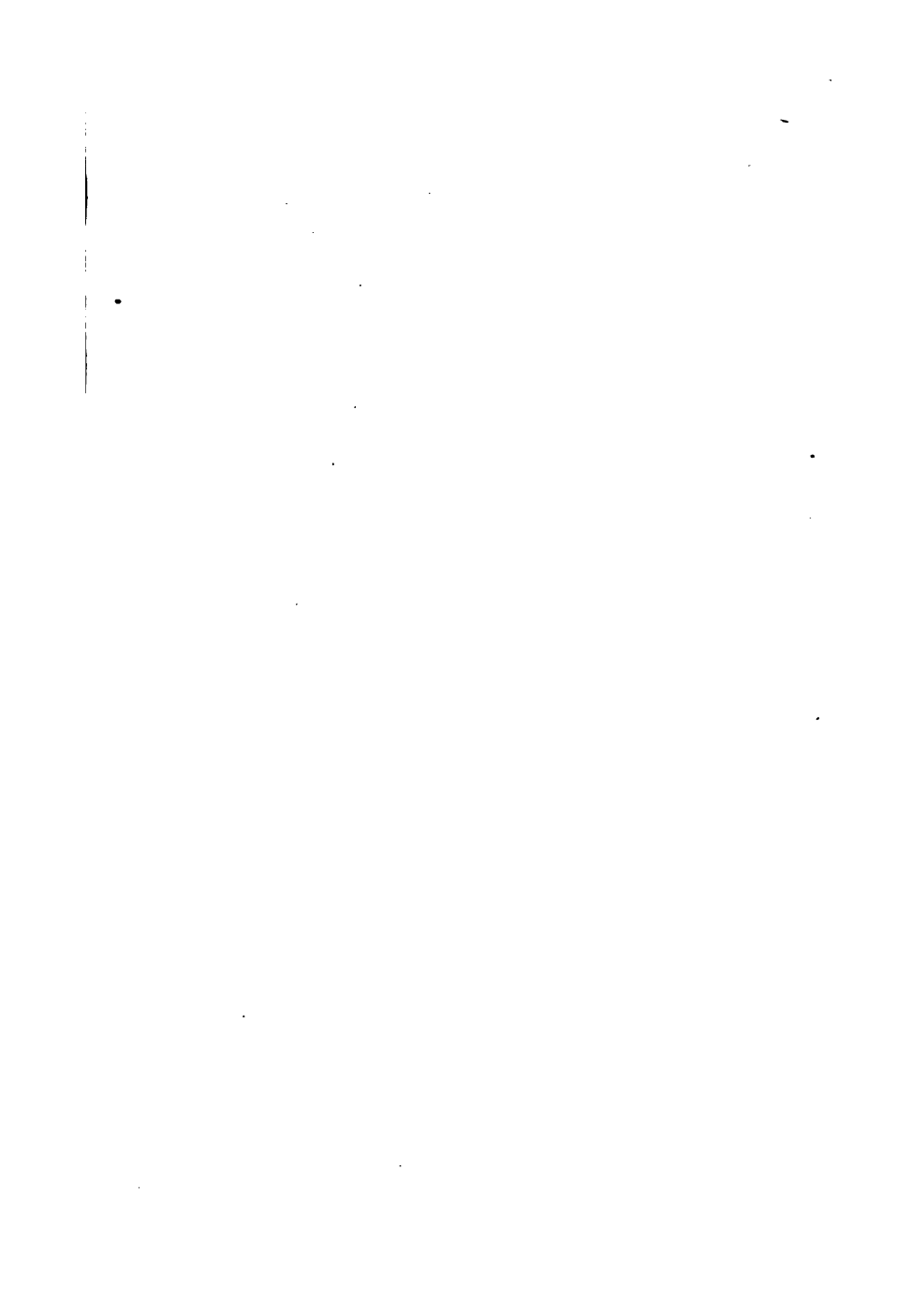
4 is in 4, once.	5 is in 5, once.	6 is in 6, once.
4 " 8, 2	5 " 10, 2	6 " 12, 2
4 " 12, 3	5 " 15, 3	6 " 18, 3
4 " 16, 4	5 " 20, 4	6 " 24, 4
4 " 20, 5	5 " 25, 5	6 " 30, 5
4 " 24, 6	5 " 30, 6	6 " 36, 6
4 " 28, 7	5 " 35, 7	6 " 42, 7
4 " 32, 8	5 " 40, 8	6 " 48, 8
4 " 36, 9	5 " 45, 9	6 " 54, 9
4 " 40, 10	5 " 50, 10	6 " 60, 10

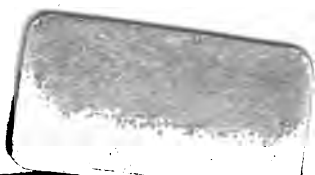
7 is in 7, once.	8 is in 8, once.	9 is in 9, once.
7 " 14, 2	8 " 16, 2	9 " 18, 2
7 " 21, 3	8 " 24, 3	9 " 27, 3
7 " 28, 4	8 " 32, 4	9 " 36, 4
7 " 35, 5	8 " 40, 5	9 " 45, 5
7 " 42, 6	8 " 48, 6	9 " 54, 6
7 " 49, 7	8 " 56, 7	9 " 63, 7
7 " 56, 8	8 " 64, 8	9 " 72, 8
7 " 63, 9	8 " 72, 9	9 " 81, 9
7 " 70, 10	8 " 80, 10	9 " 90, 10

* The word "times" is understood after the quotients, 2, 3, 4, etc.









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